DOCUMENT RESUME

ED 227 012 SO 014 479

AUTHOR	Deane, Robert T.; And Others
TITLE	Model Study for an Economic Data Program on the Conditions of Arts and Cultural Institutions. Final Report.
INSTITUTION	Applied Management Sciences, Inc., Silver Spring, Md.
SPONS AGENCY	National Endowment for the Arts, Washington, D.C.
PUB DATE	30 Jun 77
CONTRACT	NEA-C-169
NOTE	352p.; Some pages may be marginally legible due to small and light print type.
PUB TYPE	Information Analyses (070) -- Reports - Descriptive (141)
EDRS PRICE	MF01/PC15 Plus Postage.
DESCRIPTORS	Arts Centers; *Cultural Centers; *Dance; Databases; Economic Research; Expenditures; Financial Support; Grants; Long Range Planning; Models; *Music; *Predictive Measurement; Research Design; Research Reports; Statistical Data; Tables (Data); *Theater Arts; Trend Analysis; *Visual Arts
IDENTIFIERS	*Econometrics

ABSTRACT

The development of econometric models and a data base to predict the responsiveness of arts institutions to changes in the economy is reported. The study focused on models for museums, theaters (profit and non-profit), symphony, ballet, opera, and dance. The report details four objectives of the project: to identify useful databases and studies on the economics of the visual and performing arts, construct a series of econometric models characteristic of the arts industry, acquire data and create analytical files, and estimate and analyze the models. Models for each of the arts forms are presented in detail as well as a model for all the art forms combined. Data were obtained from the Ford Foundation, Theatre Communications Group, Center for Policy Research, other foundation reports, books, and periodicals. Variables included demand; cost; price; federal, regional, and foundation grants; private contributions; capacity extension factor; fund raising expenditures; and subscription sales. The estimation process, in which the acquired data were applied to the conceptual models, indicates that preliminary efforts at model estimation accurately describe a large part of the behavior of various organizations. Over 100 graphs and tables are contained in the document. (KC)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED227012

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
☐ This document has been reproduced as received from the person or organization originating it.
X Minor changes have been made to improve reproduction quality.
• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

G-102

MODEL STUDY FOR AN ECONOMIC DATA PROGRAM ON THE CONDITIONS OF ARTS AND CULTURAL INSTITUTIONS

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
Tom Bradshaw
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

Final Report

June 30, 1977

Prepared for:

Research Division
National Endowment for the Arts

In accordance with:

Contract No. NEA C 169

sd on 1/79

962 Wayne Avenue • Suite 701 • Silver Spring, Maryland 20910
Telephone 301 585-8181

APPLIED MANAGEMENT SCIENCES

Principal Authors: Robert T. Deane, Ph.D.
Ibrahim A.S. Ibrahim, M.A.

Contributing Author: Thomas I. Litkowski, B.A.

ACKNOWLEDGMENTS

In addition to the authors cited above, executive leadership of the project was provided by Dr. Todd S. Tucker, President of Applied Management Sciences, and Mr. Douglas E. Skinner, Senior Vice-President of Applied Management Sciences. Special thanks must be given to Mr. Laurence Smith of the Applied Management Sciences' staff for his assistance, to Mr. Samuel T. Redwine, Mr. Anthony V. Chessick, and Mr. Barry W. Philipp, who provided the file development programming expertise in the study. Applied Management Sciences also wishes to express its gratitude to Mr. Harold Horowitz, Director of the Research Division of the National Endowment for the Arts, who was the Project Officer on the study, and Mr. David Waterman, Research Economist of the Research Division of the National Endowment for the Arts, for their advice, assistance, and guidance throughout the study. Applied Management Sciences would also like to express its appreciation to the consultants for the project: Mr. Thomas Fichandler, Executive Director of the Arena Stage; Mr. James Morris, Director of the Division of Performing Arts at the Smithsonian Institution; and Mr. Donald Nicholas, Deputy Director of the Virginia Museum of Fine Arts. It was by picking these men's minds that the conceptual bases for the models were developed.

Applied Management Sciences also appreciates the assistance of the individuals and organizations who joined or assisted in the data collection effort: Mr. Richard C. Sheldon, Director of the Office of the Arts; Ford Foundation and Miss Rita Roosevelt, also of the Ford Foundation, who provided the data for Non-Profit Theater, Opera, Symphony Orchestra, Ballet, and Dance; Mr. Henry Schwenker and Mr. Robert Gett of Touche-Ross & Co., who provided the updates for the Non-Profit Theater with data from the Theater Communications Group; Mr. Harry I. Greenfield and Mr. Samuel Schwarz of the Center for Policy Research, who provided selected data on symphony orchestras from the American Symphony Orchestra League, and who assisted in the collection of the museum time series data; Ms. Toril McCagg of the National Research Center of the Arts, who provided the cross-sectional data for museums; and Mrs. J. Diepenbrock of the Office of Museum Programs at the Smithsonian Institution, who assisted in the collection of the museum time series data. In addition, thanks is given to Mr. John Schlater and the Academic Computing Center at the University of Wisconsin-Madison for supplying the Box-Jenkins algorithm. Applied Management Sciences also wishes to thank Dr. D. Newlon and Dr. S. Kohlhagen for their helpful comments at several stages of the project.

TABLE OF CONTENTS

Section		Page
I.	INTRODUCTION	1
II.	REVIEW OF THE LITERATURE	6
	A. Introduction	6
	B. For-Profit Institutions	7
	C. Non-Profit Institutions	9
III.	GENERAL MODEL DEVELOPMENT	13
	A. Introduction	13
	B. The General Models	15
	1. For-Profit Theater	16
	2. Non-Profit Art Organizations	20
	C. The Transition from General Models to Conceptual Models	24
IV.	FINDINGS OF THE REVIEW OF EXISTING DATA SYSTEMS	25
	A. Introduction	25
	B. For-Profit Theater	27
	C. Non-Profit Theater	29
	D. Opera	32
	E. Symphony	32
	F. Ballet	33
	G. Modern Dance	33
	H. Museum	34
	RECOMMENDATIONS	39
	For-Profit Theater	39
	Non-Profit Organizations (Excluding Museum)	40
	Museum	42
V.	CONCEPTUAL ECONOMETRIC MODELS	43
	A. Introduction	43
	B. The Conceptual Models	43
	1. For-Profit Theater	44
	2. Non-Profit Theater	47
	3. Opera	54
	4. Symphonies	60
	5. Ballet and Dance	66
	6. Museums	67

TABLE OF CONTENTS (Contd.)

Section		Page
VI.	ECONOMETRIC MODEL ESTIMATION	75
	A. Introduction	75
	B. Model Estimates	76
	1. For-Profit Theater, Broadway	77
	2. Non-Profit Art Organizations Excluding Museums	81
	a. All Art Forms Combined	81
	(1) Demand	82
	(2) Cost	86
	(3) Price	87
	(4) Federal Grants	88
	(5) Regional Grants	88
	(6) Private Contributions	89
	(7) Foundation Grants	89
	(8) Capacity Expansion Factor	90
	(9) Fund Raising Costs	90
	(10) Subscription Sales	91
	b. Non-Profit Theater	92
	(1) Demand	92
	(2) Cost	95
	(3) Price	95
	(4) Federal Grants	95
	(5) Regional Grants	96
	(6) Private Contributions	96
	(7) Foundations' Grants	97
	(8) Capacity Expansion Factor	97
	(9) Fund Raising Expenditures	98
	(10) Subscription Sales	98
	c. Opera	98
	(1) Demand	101
	(2) Cost	102
	(3) Price	102
	(4) Federal Grants	102
	(5) Regional Grants	102
	(6) Private Contributions	103
	(7) Foundations' Grants	103
	(8) Capacity Expansion Factor	104
	(9) Fund Raising Expenditures	104
	(10) Subscription Sales	104
	d. Symphony	105
	(1) Demand	108
	(2) Cost	108
	(3) Price	108

TABLE OF CONTENTS (Contd.)

Section			Page
VI.		(3) Price	108
		(1.a) Demand	111
		(2.a) Cost	111
		(3.a) Price	111
		(4) Federal Grants	113
		(5) Regional Grants	113
		(6) Private Contributions	114
		(7) Foundations Grants	114
		(8) Capacity Expansion Factor	114
		(9) Fund Raising Expenditures	115
		(10) Subscription Sales	115
	e.	Ballet	115
		(1) Demand	118
		(2) Cost	118
		(3) Price	118
		(4) Federal Grants	119
		(5) Regional Grants	119
		(6) Private Contributions	119
		(7) Foundations' Grants	120
		(8) Capacity Expansion Factor	120
		(9) Fund Raising Expenditures	120
		(10) Subscription Sales	121
	f.	Modern Dance	121
	3.	Museums	122
	a.	Programs, Publications, and Services Revenue	122
	b.	Membership Count	125
	c.	Annual Total Attendance	126
	d.	Price of Admission	126
	e.	Federal Grants	127
	f.	Regional Grants	127
	g.	Private Contributions	128
	h.	Foundation Grants	129
	i.	Annual Operating Expenditures	129
	j.	Expenditures on Educational Programs	129
	k.	Annual Cost of Research Activities	130
	l.	Annual Advertising and Promotional Expenditures	130
	m.	Change in the Stock of Exhibit Items	131

TABLE OF CONTENTS (Contd.)

Section		Page
VII.	TREND MODEL ESTIMATION AND FORECASTING	132
	A. Introduction	132
	B. For-Profit Theater	135
	C. All Non-Profit Art Forms Combined (Excluding Museums)	139
	D. Non-Profit Theater	141
	E. Opera	143
	F. Symphony	146
	G. Ballet	149
	H. Modern Dance	149
	I. Museum	151
VIII.	SUMMARY AND CONCLUSIONS	153
	A. Introduction	153
	B. Methodological Approaches	154
	1. Econometric Modelling	155
	a. Conceptual Model Development	155
	b. Data Base Acquisition and Preparation	157
	(1) For-Profit Theater	157
	(2) Non-Profit Art Forms (Excluding Museum)	158
	(3) Museum	158
	c. Model Estimation and Analysis	158
	2. Trend Modelling	159
	a. Preparation of the Algorithm	160
	b. Data Base Acquisition and Preparation	160
	c. Model Estimation and Analysis	161
	C. Selected Research Findings	161
	1. Data	161
	2. Behavioral vs. Trend Modelling	164
	3. Findings from Behavioral Modelling	165
	a. General vs. Specific Models	165
	b. Relative Behavioral Model Performances	166
	c. Selected Empirical Findings	167
	(1) Grants and Contributions	168
	(2) Attendance	172
	(3) Pricing	173
	(4) Subscription Sales	173
	(5) Worker Productivity	174
	(6) The Impact of General Economic Conditions on the Income Gap	174
	D. Recommendations	177

Unit 7

TABLE OF CONTENTS (Contd.)

Section		Page
	BIBLIOGRAPHY	
APPENDIX A:	SUMMARIES OF PREVIOUS POLICY STUDIES	
APPENDIX B:	EQUATION ESTIMATES FOR ALTERNATIVE SPECIFICATIONS FOR EACH MODEL	
APPENDIX C:	TREND MODELS	

LIST OF ILLUSTRATIONS

Figure		Page
1	PROFIT MAXIMIZATION SOLUTION FOR THE INDIVIDUAL ORGANIZATION	14
2	ATTENDANCE MAXIMIZATION WITH ZERO-PROFIT CONSTRAINT FOR THE INDIVIDUAL ORGANIZATION	14
Table		
1	For-Profit Theater - Conceptual Model	45
2	For-Profit Theater - Endogenous and Exogenous Variables	46
3	Non-Profit Theater - Conceptual Model	49
4	Non-Profit Theater - Endogenous and Exogenous Variables	50&51
5	Opera - Conceptual Model	55
6	Opera - Endogenous and Exogenous Variables	56&57
7	Symphonies - Conceptual Model	61
8	Symphonies - Endogenous and Exogenous Variables	62&63
9	Museums - Conceptual Model	68&69
10	Museums - Endogenous and Exogenous Variables	70&71
11	Selected Estimates for the Demand Function for the For-Profit Theater Model	78
12	The Variables Used in the Demand Functions for the For-Profit Theater Model	79
13	Selected Estimates for all Art Forms Combined, Excluding Museums Model	83
14	Variables Used in All Art Forms Combined, Excluding Museums, Model	84
15	Selected Estimates for the Non-Profit Theater Model . .	93
16	The Variables Used in the Non-Profit Theater Model . .	94

LIST OF TABLES (Continued)

Table	Title	Page
17	Selected Estimates for the Opera Model	99
18	The Variables Used in the Opera Model	100
19	Selected Estimates for the Symphony Model Based on the Ford Foundation Data	106
20	The Variables Used in the Symphony Model in Table 19	107
19.a	Selected Estimates for the Symphony Model Based on the American Symphony Orchestra League Data Supplied by the Center for Policy Research	112
20.a	The Variables Used in the Symphony Model of Table 19.a.	112
21	Selected Estimates for Ballet Model	116
22	The Variables Used in the Ballet Model	117
23	Selected Estimates for the Museum Model	123
24	The Variables Used in the Model for Museums	124
25	Data Sets Available for Each Art Form	134
26	Estimated Box-Jenkins Models for the For-Profit Theater (Broadway)	136
27	Forecasts of For-Profit Variables Using Box-Jenkins Model Estimates	138
28	Box-Jenkins Model Estimates and Forecasts and Ford Foundation Growth Model Forecasts for All Art Forms Combined	140
29	Box-Jenkins Model Estimates and Forecasts and the Ford Foundation Growth Model Forecasts for Non-Profit Theater	142
30	Box-Jenkins Model Estimates and Forecasts for Non-Profit Theater	144
31	Box-Jenkins Model Estimates and Forecasts and the Ford Foundation Growth Model Forecasts for Opera	145
32	Box-Jenkins Model Estimates and Forecasts and the Ford Foundation Growth Model Forecasts for the Symphony	147

LIST OF TABLES (Continued)

Table	Title	Page
33	Box-Jenkins Model Estimates and Forecasts for Symphonies	148
34	Box-Jenkins Model Estimates and Forecasts and the Ford Foundation Growth Model Forecasts for Ballet	150
35	Box-Jenkins Model Estimates and Forecasts for the Museum Time Series	152
36	Factors Effecting Governmental and Private Grants and Contributions for Non-Profit Art Organizations Excluding Museums	169
37	Impact of Economic and Policy Variables on the Income Gap for Selected Art Forms	175
	APPENDIX B	
B.1	The Variables Used in the Demand Functions for the For-Profit Theater Model	B.2
B.2	Estimated Average February Attendance for All Shows -- For-Profit Theater	B.3
B.3	Estimated Average February Audience Size Per Performance for All Shows	B.3
B.4	Estimated Average February Weekly Attendance for Plays -- For-Profit Theater	B.4
B.5	Estimated Average February Weekly Attendance for Musicals -- For-Profit Theater	B.4
B.6	The Variables Used in the Models for Non-Profit Art Organizations Excluding Museums	B.5
B.7	Estimated Average Utilization Rate -- All Non-profit Art Organizations Excluding Museums	B.6
B.8	Estimated Annual Total Ticketed Attendance -- All Non-profit Art Organizations Excluding Museums	B.6
B.9	Estimated Total Operating Expenditures Net of Fund Raising Costs -- All Non-profit Art Organizations Excluding Museums	B.7
B.10	Estimated Average Realized Price Per Ticket Sold -- All Non-profit Art Organizations Excluding Museums	B.7

LIST OF TABLES (Continued)

Table	Title	Page
B.11	Estimated Annual Federal Grants -- All Non-profit Art Organizations Excluding Museums	B.8
B.12	Estimated Annual Grants from Regional Government Agencies -- All Non-profit Art Organizations Excluding Museums	B.8
B.13	Estimated Annual Private Contributions -- All Non-profit Art Organizations Excluding Museums	B.9
B.14	Estimated Annual Grants by Foundations -- All Non-profit Art Organizations Excluding Museums	B.10
B.15	Estimated Capacity Expansion Factor -- All Non-profit Art Organizations Excluding Museums	B.10
B.16	Estimated Annual Fund-Raising Expenditures -- All Non-profit Art Organizations Excluding Museums	B.11
B.17	Estimated Subscription Sales -- All Non-profit Art Organizations Excluding Museums	B.11
B.18	Estimated Average Utilization Rate -- Non-profit Theater	B.12
B.19	Estimated Annual Total Ticketed Attendance -- Non-profit Theater	B.12
B.20	Estimated Total Operating Expenditures Net of Fund Raising Costs -- Non-profit Theater	B.13
B.21	Estimated Average Realized Price Per Ticket Sold -- Non-profit Theater	B.13
B.22	Estimated Annual Federal Grants -- Non-profit Theater	B.14
B.23	Estimated Annual Grants from Regional Government Agencies -- Non-profit Theater	B.14
B.24	Estimated Annual Private Contributions -- Non-profit Theater	B.15
B.25	Estimated Annual Grants by Foundations -- Non-profit Theater	B.16
B.26	Estimated Capacity Expansion Factor -- Non-profit Theater	B.16

LIST OF TABLES (Continued)

Table	Title	Page
B.27	Estimated Annual Fund Raising Expenditures -- Non-profit Theater	B.16
B.28	Estimated Subscription Sales -- Non-profit Theater	B.17
B.29	Estimated Average Utilization Rate -- Opera	B.18
B.30	Estimated Annual Total Ticketed Attendance -- Opera	B.18
B.31	Estimated Total Operating Expenditures Net of Fund Raising Costs -- Opera	B.19
B.32	Estimated Average Realized Price Per Ticket Sold -- Opera	B.19
B.33	Estimated Annual Federal Grants -- Opera	B.20
B.34	Estimated Annual Grants from Regional Government Agencies -- Opera	B.20
B.35	Estimated Annual Private Contributions -- Opera	B.21
B.36	Estimated Annual Grants by Foundations -- Opera	B.22
B.37	Estimated Capacity Expansion Factor -- Opera	B.22
B.38	Estimated Annual Fund Raising Expenditures -- Opera	B.23
B.39	Estimated Subscription Sales -- Opera	B.23
B.40	Estimated Average Utilization Rate -- Symphony Based on the Ford Foundation Data	B.24
B.41	Estimated Annual Total Ticketed Attendance -- Symphony Based on the Ford Foundation Data	B.25
B.41.a	Estimated Total Ticketed Attendance -- Symphony Based on the American Symphony Orchestra League Data Supplied by the Center for Policy Research	B.26
B.42	Estimated Total Operating Expenditures Net of Fund-Raising Costs -- Symphony Based on the Ford Foundation Data	B.26
B.42.a	Estimated Total Operating Expenditures -- Symphony Based on the American Symphony Orchestra League Data Supplied by the Center for Policy Research	B.27

LIST OF TABLES (Continued)

Table	Title	Page
B.43	Estimated Average Realized Price Per Ticket Sold -- Symphony Based on the Ford Foundation Data	B.27
B.43.a	Estimated Price of Admission -- Symphony Based on the American Symphony Orchestra League Data Supplied by the Center for Policy Research	B.28
B.44	Estimated Annual Federal Grants -- Symphony Based on the Ford Foundation Data	B.28
B.45	Estimated Annual Grants From Regional Government Agencies -- Symphony Based on the Ford Foundation Data	B.29
B.46	Estimated Annual Private Contributions -- Symphony Based on the Ford Foundation Data	B.30
B.47	Estimated Annual Grants by Foundations -- Symphony Based on the Ford Foundation Data	B.31
B.48	Estimated Capacity Expansion Factor -- Symphony Based on the Ford Foundation Data	B.31
B.49	Estimated Annual Fund-Raising Expenditures -- Symphony Based on the Ford Foundation Data	B.32
B.50	Estimated Subscription Sales -- Symphony Based on the Ford Foundation Data	B.32
B.51	Estimated Average Utilization Rate -- Ballet	B.33
B.52	Estimated Annual Total Ticketed Attendance -- Ballet	B.34
B.53	Estimated Total Operating Expenditures Net of Fund Raising Costs -- Ballet	B.35
B.54	Estimated Average Realized Price Per Ticket Sold -- Ballet	B.35
B.55	Estimated Annual Federal Grants -- Ballet	B.36
B.56	Estimated Annual Grants from Regional Government Agencies -- Ballet	B.36
B.57	Estimated Annual Grants by Foundations -- Ballet	B.37
B.58	Estimated Annual Grants by Foundations -- Ballet	B.38
B.59	Estimated Capacity Expansion Factor -- Ballet	B.38

BLANK PAGE
DO NOT FILM

LIST OF TABLES (Continued)

Table	Title	Page
B.60	Estimated Annual Fund Raising Expenditures -- Ballet	B.39
B.61	Estimated Subscription Sales -- Ballet	B.39
B.62	The Variables Used in the Model for Museums	B.40
B.63	Estimated Sum of Programs, Publications, and Services Revenue	B.41
B.64	Estimated Membership Count	B.41
B.65	Estimated Annual Total Attendance	B.42
B.66	Estimated Price of Admission	B.42
B.67	Estimated Annual Federal Grants and Support	B.43
B.68	Estimated Annual State and Local Grants and Support	B.43
B.69	Estimated Annual Private Contributions	B.44
B.70	Estimated Annual Foundation Grants	B.44
B.71	Estimated Annual Operating, Production, Costs	B.45
B.72	Estimated Annual Educational and Other Group Programs' Costs	B.45
B.73	Estimated Annual Costs of Research Activities	B.46
B.74	Estimated Annual Advertising and Promotional Expenditures	B.46
B.75	Estimated Change in the Stock of Exhibit Items	B.47

I. INTRODUCTION

The National Endowment for the Arts (NEA), an agency of the Federal government, is responsible for providing grants-in-aid to state art agencies and non-profit organizations, as well as to individuals of exceptional talent, to assist in the continual development of the arts and culture in the United States. Authorized by the National Foundation on the Arts and Humanities Act of 1965, as amended, the NEA provides support of two types: (1) Program Funds, which are appropriated by the United States Congress; and (2) Treasury Funds, which are provided on a matching basis, and which become available only after private donations are received. The annual appropriations by the NEA have increased substantially over the years, rising from $2.5 million in fiscal year 1966 to $75 million in fiscal year 1975.

In September 1976, the National Endowment for the Arts awarded Applied Management Sciences a contract to develop models of arts and cultural institutions and their responses to changes in general economic conditions. The responsive behavior of various types of arts and cultural institutions is largely unknown, and it is necessary for planning purposes (on the part not only of the NEA, but also other governmental and private agencies and foundations engaged in supporting the arts) that the impacts of local and general economic changes on the several types of arts and cultural institutions be better understood. That is, how is a symphony likely to react to a recession? What happens to its attendance? What happens to the number of performances? Prices? What alternative source of revenue does it seek? Are the effects serious enough to threaten the economic viability of the symphony? Progress toward these and other questions must be made in order that interested organizations may properly anticipate the more serious threats to arts and cultural institutions as a result of local and/or general cyclical (including trending) behavior of the economy. Accordingly, the primary goals of this research effort were the development of a set of equation systems (models) and data recommendations for the necessary data to serve as a base for predictions regarding the economic behavior of arts and cultural institutions. Specifically, the study focused on models of the following institutions:

- museums
- theater--for profit and non-profit
- symphony, ballet, opera, and dance

The methodology used in conducting the research effort was comprised of four major activities: (1) a literature search and review; (2) the construction of a series of econometric models; (3) the acquisition of data and the creation of analytical files; and (4) the estimation and analysis of the models. The literature search and review task involved the acquisition of materials in two principal categories: (1) studies/reports which identified data bases useful for the present effort, and (2) efforts which were relevant from a policy standpoint and which contained potentially useful data bases not previously identified.

The conduct of the literature search resulted in the identification of a limited number of studies on the economics of the performing and the visual arts. Most literature relevant to the present effort stopped short of the conceptualization (much less the estimation) of econometric models, and those modelling efforts identified were quite primitive. This is a natural result of the absence of a systematic data collection effort; and the non-profit nature of a large part of the industry which places it outside of the application of conventional economic theory. Detailed descriptions of the results of the literature review phase of the present study are presented in Section II, which is a review of previous policy studies, and Section IV, which contains an overview of existing data bases.

The second major activity undertaken was the conceptualization of a set of models characterizing the arts and culture industry. The institutions to be studied are:

1. For-Profit Theater,
2. Non-Profit Theater,
3. Opera,
4. Symphony,
5. Ballet,
6. Modern Dance, and
7. Museums.

During the conceptualization process, these institutions were grouped into "for-profit" and "non-profit" categories, with the categorization being conducted according to the tax-exempt status of the institution. This resulted in the following groupings:

1. For-profit theater; these are viewed as profit maximizers.
2. Non-profit institutions: these are viewed as pursuing a constrained output maximization, and are divided into the following six subgroups:
   a. Non-Profit Theater,
   b. Opera,
   c. Symphony,
   d. Ballet,
   e. Modern Dance, and
   f. Museums.

Given these groupings, econometric models were constructed containing the following components:

- a supply of performances or exhibit-days component,
- a demand component for the audience, and
- a capital accumulation component.

In addition, the models for non-profit institutions included an unearned income component. All the models developed during this phase of the study contain simultaneous equations, and were specified to account for general economic conditions at national as well as regional levels (see Section V of this report).

The third activity conducted during the study was the acquisition of all requisite data and the creation of appropriate analytical files. As pointed out in Section IV of this report, the survey of the existing data systems evidenced several deficiencies in the data which impacted on the estimation of the models. These deficiencies were of three major types: (1) certain data elements for arts organizations were missing in both cross-sectional and time-series data systems; (2) the observations were sparse for certain elements in the time-series data systems; and (3) the data were not always available for individual organizations, but only as aggregates for the art form. The causes of these deficiencies are discussed in

great detail in Section IV. Despite the deficiencies in the data sets, usable analytical files were created and the estimation of the models was effected.

The final task was the estimation of each of the simultaneous-equation models. This suggested the use of a two-stage least squares or similar techniques in the estimation process. However, due to limitations in the available data, it was not possible to utilize two-stage least squares since the number of instrumental variables in the system is greater than the number of observations which rules out the first stage of this technique. For example, within the Ford Foundation data, which was the principal data source for most of the non-profit arts and cultural organizations, the data set spans an interval of only nine years. Therefore, ordinary least squares was used, rather than a two-stage approach. In the For-Profit Theater model, the data spans a much longer (1899-1974) period, but since no usable cost or capacity data are available, the For-Profit Theater model was reduced to a single estimatable equation. In addition, exogenous data were sufficient only for an ordinary least squares approach on this single equation.

It should be pointed out, as a final note, that the key tasks in the research effort were the conceptualization of the models and the development of appropriate data bases. The application of the data to the models should be thought of as only an initial step in the attempt to forecast the needs and demands of arts and cultural institutions. The empirical results posited below are not provided as definitive, but rather as a demonstration of the feasibility of conducting further indepth work and for suggesting directions for such work. Indeed, the preliminary results obtained by using the limited data bases available produced very interesting and useful results. Such results are very encouraging and emphasize both the need for, and the potential return from, additional efforts at acquiring suitable data bases. Data are the weakest component to this point in the development of individual simulation models for forecasting purposes. A

perfectly correct, true, and valid conceptual model cannot be used for policy decision-making in the absence of such data. Therefore, it is hoped that the substantial progress that has been made to this point without sufficient data will stimulate those data acquisition efforts which will lead to fully operational forecasting (simulation) models for each of the several types of arts and cultural institutions.

II. REVIEW OF THE LITERATURE

A. Introduction

As was pointed out in the introduction to this report, the literature pertaining to the economics of the performing and visual arts is quite limited. In general, none of the previous studies attempted to model the economic aspects of arts and cultural institutions. This can be explained in part by the shortage of adequate data bases and to the non-profit nature of the majority of the industry. The two most relevant studies for the present effort were: (1) Baumol and Bowen, Performing Arts-The Economic Dilemma, and (2) Thomas Moore, The Economics of the American Theater. Many of the other studies emphasized other aspects of the industry, such as the need for funding, and were less useful to the present modelling effort.

Despite the limited literature on the economics of the performing and visual arts, several research efforts were identified that appeared to be of relevance to the present study. In fact, the review of these studies, a summary of which is presented here, played a significant role in the conceptualization and development of the models presented later in this report. The purpose of this section of the report is to describe, in summary fashion, the studies which Applied Management Sciences considered most important, highlighting the principal components of each, as well as appropriate findings, conclusions and deficiencies vis-a-vis the present modelling effort. Appendix A contains a more detailed presentation of the studies reviewed here, including specifications of models, variables, etc. A bibliography is provided at the end of this report.

From the standpoint of economic theory, two generic groups of arts and cultural institutions can be identified: For-Profit organizations and Non-Profit institutions. The For-Profit segment of the industry is represented by the For-Profit New York (Broadway) theater. The Non-Profit sector, on the other hand, is comprised of several art forms, including:

- Non-Profit Theater
- Opera
- Modern Dance
- Ballet
- Symphonies
- Museums

These forms are discussed as one group, due to similarities in financial characteristics and modes of operation.

B. For-Profit Institutions

The literature pertaining to the economics of the For-Profit Theater was the most relevant from the point of view of the present study. Of the literature identified, four studies were found to be of particular value in the conceptualization and development of the For-Profit theater model. These studies were: (1) Theater in America-Jack Poggi; (2) The Economics of the Theater-Anthony Hilton; (3) Performing Arts-The Economic Dilemma-Baumol and Bowen; and (4) The Economics of the American Theater- Thomas Moore. The reports by Anthony Hilton and Jack Poggi provided a cursory overview of the economics of the theater, while the studies conducted by Thomas Moore and Baumol and Bowen were of a more rigorous nature.

The literature on the For-Profit Theater generally focuses on the decline of the American theater, with particular emphasis on financial problems. It traces the development of the theater from the resident stock to the combination companies. As audiences became more sophisticated and demanded higher quality productions, resident stock companies, in which the same set of actors performed many different plays, became less and less able to compete with the combination companies, where actors were hired on a production by production basis. This development led to the centralization of the American theater, where the market could support the commercial theater. The major center was and continues to be Broadway.

In general, the twentieth century began with the theater a seemingly healthy enterprise. But this state of affairs concealed

an inherent weakness. This weakness was discussed in great detail by Moore, Baumol and Bowen, and Hilton in their respective studies, and relates to the increasing costs of putting on a show accompanied by lack of gains in productivity. In virtually every other industry, the twentieth century has brought remarkable increases in labor productivity, due to better technology, economies of scale, and an increased capital stock. The live production, however, has generally not shared in the increase in productivity. Although some technological advances have aided the theater (such as quicker transportation), they have not been sufficient to substantially increase the productivity of the performer. As the costs of production continue to rise, the gap between productivity gains and cost increases continues to rise. As Baumol and Bowen point out, "the extent of the increase in relative costs (in the live performing arts) where productivity is stationary will vary directly with the economy-wide rate of increase in output per man-hour. The faster the general pace of technological advance, the greater will be the increase in the overall wage level, and the greater will be the upward pressure on costs in any industry which does not enjoy increased productivity." (p. 171).

Another aspect of the For-Profit Theater industry discussed by several authors was the lack of flexibility of theater-owners with respect to ticket pricing policy. Anthony Hilton states that since the demand for performances is relatively inelastic with respect to price, theater-owners should raise ticket prices, especially in times of peak demand (such as weekends). Moore produces statistical evidence to support this claim. In his analysis of the demand for shows, Moore found that the price elasticity was significantly less than one (-.48). Based upon these findings, Moore recommended that rules governing pricing should be repealed or modified so that the theater can adjust its prices to changes in the market.

The composition of the audiences for theatrical productions was also discussed by several of the authors. As pointed out by

Baumol and Bowen, "the audience is drawn from an extremely narrow segment of the American population. In the main, it consists of persons who are extraordinarily well educated, whose incomes are very high, who are predominantly in the professions, and who are in their late youth or early middle age." However, even as the audience for the theater becomes more affluent, a corresponding increase in theater attendance has not occurred. In fact, Moore found that a 1 percent increase in income led to only a .2 percent increase in the price of the ticket bought. At the same time, the increase in expenditures for complementary goods, such as travel and food, increased by .35 percent. So even though the theatergoer spends more on an evening at the theater as his income increases, the increase is not totally captured by the theater in terms of increased revenues. This fact has added to the financial problems of the For-Profit Theater.

Another development which has affected For-Profit Theater is the increased use of the mass media as an instrument for spreading the arts and culture to a wider audience. The emergence of the mass media has had several effects on the theater industry. First, it served as a drain on the stock of labor, as actors left the theater industry for the seemingly more lucrative movie and television industries. The increasing availability of performances through the mass media also affected attendance in the theater industry. Despite dramatic increases in population and technologically advanced transportation systems, the increase in Broadway theater attendance has been slight since the 1930s. However, due to differences in the values placed on television versus live performances, the effect on attendance at the theater is difficult to isolate.

C. Non-Profit Institutions

The literature pertaining to the economics of non-profit performing and visual arts organizations proved to be quite limited. In addition to the study by Baumol and Bowen mentioned earlier, three other studies were identified, only one of which involved a modelling effort. These three studies were: (1) The Finances of the Performing Arts-Ford Foundation; (2) A Study of the Non-Profit

Arts and Cultural Industry of New York State-National Research Center of the Arts, Inc.; and (3) The Pattern of Performing Arts Financing-Bruce Seaman. The first two studies were simply data collection efforts involving surveys of arts and cultural institutions, while Seaman attempted to model the behavior of performing arts organizations.

The economics of non-profit institutions is somewhat different from the For-Profit Theater. This difference is explained to a large extent by the underlying purposes of non-profit arts and cultural institutions. One of these purposes is the attempt to broaden the audience base to include persons who normally would not attend such performances. This is accomplished largely by minimizing prices charged and increasing the number of exhibits or performances. This "community awareness" on the part of arts and cultural organizations tends to limit changes in the price of admission on "moral grounds," as pointed out by Baumol and Bowen. Due to the rigidity in ticket prices, many non-profit organizations are increasingly being confronted with a widening income gap. As Baumol and Bowen state, "the income gap has been growing, and it has been doing so quite steadily." (p. 292). Further, a study of non-profit arts and cultural institutions in New York State by the National Research Center for the Arts shows that an income gap exists for 54 percent of all organizations surveyed.

Because of the widening gap between earned income and costs, and due to the rigid pricing structures inherent in the industry, non-profit arts and cultural organizations have become increasingly dependent on income from other sources; namely, grants and contributions. This "unearned income" can come from several sources, including: (1) private contributions; (2) foundation support; and (3) government subsidies. Private philanthropy includes both individual and corporate contributions to the arts. Up until the late 1960s, private contributions represented the largest source of unearned income for arts and cultural institutions. However, these contributions were not obtained freely; the organizations had to develop procedures for soliciting philanthropy, and had to compete

with many other potential recipients, such as educational and religious organizations. The solicitation process thus represents a cost to the arts and cultural organizations seeking donations from individuals and/or corporations.

Despite the magnitude of private philanthropy, little was accomplished in the way of decreasing the income gap of arts and cultural organizations. One solution to this problem was the increasing role of foundations in the support of such institutions. The largest of the foundations is the Ford Foundation, which has been the most important single contributor for several years. Since the Ford Foundation began its program for supporting the arts in 1957, it has contributed approximately 4 percent of its grants in this area each year.

The role of the foundation in supporting arts and cultural organizations is a vital one. As pointed out by Baumol and Bowen, "because the large foundations can act with deliberation and can base their decisions about grants on an adequate program of preliminary research, they can undertake non-routine types of support which are nevertheless of crucial importance." (p. 343). In addition, foundations have recently begun to realize that an important part of their contributions can be used to help close the income gap. This realization is an important step forward for the arts and cultural organizations seeking foundation grants.

The final source of "unearned income" for the arts and cultural institutions is governmental--municipal, state, and Federal. Support by municipalities can take two forms: direct and indirect. Direct support involves direct subsidies of arts and cultural organizations. This type of support has historically not been very substantial, except in the case of museums. Its future may not be bright, since cities are increasingly being faced by financial pressures in other more vital areas. Indirect support, on the other hand, involves no outlay of funds by the municipality. Rather, arts and cultural institutions are permitted to use municipal facilities at little or no out-of-pocket cost. The magnitude of such indirect support, however, has not been measured.

Support for the performing and visual arts by State governments has also historically been relatively small. Arts Agencies are increasingly becoming popular as a source of support for the arts and cultural activities within individual states, and it is believed that this type of support will increase. As Baumol and Bowen state it, ". . .the principle of state support is rapidly gaining acceptance, and one can predict with a fair degree of confidence that funds from this source will increase in the future." (p. 352).

Federal government support for the performing and visual arts has increased dramatically over the past decade. Before the middle of the 1960s, most Federal support for arts and cultural organizations took the form of various tax exemption provisions. In 1965, the National Council on the Arts was established, authorizing the Federal government to make direct financial contributions to the performing arts. The total appropriations for the National Endowment for the Arts have increased from approximately $2.5 million in fiscal year 1966 to over $75 million in 1975. This increasing support has done much to alleviate some, but not all, of the financial problems faced by non-profit arts and cultural institutions.

In developing the models of non-profit arts organizations for the present effort, the industry's dependency on external funding had to be taken into account. Since such organizations have to compete with other industries in the economy for significant contributions, the costs and effort of obtaining such contributions has become a major factor in the industry's operations. Therefore, the concept of unearned income in the non-profit section of the models, unlike the For-Profit institutions, occupied an important place in the modelling effort.

III. GENERAL MODEL DEVELOPMENT

A. Introduction

For purposes of this study, the performing and visual arts organizations were classified into two categories:

1. organizations that were set up as commercial enterprises; e.g., Broadway theaters, and
2. organizations that were set up as non-profit enterprises; e.g., museums, opera and ballet.

In order to properly assess the several data bases available to us and to model the behavior of these organizations, it was necessary first to identify their objective functions (i.e., the goals pursued by the organizations). The goal (objective function) of a commercial theater is profit maximization. This goal is a direct result of the obligation of the producers to the initial investors who expect maximal returns on their investments.

The objective function of a non-profit organization cannot be assumed to be profit maximization, however. This complicated the identification of an objective function for this group. As a result, a panel of consultants was convened to assist in this identification process. These consultants were:

- Mr. Thomas Fichandler, who is currently the Executive Director of the Arena Stage, the President of the League of Resident Theaters, and the Vice-President of the Washington Drama Society.
- Mr. James Morris, who is currently the Director of the Division of the Performing Arts at the Smithsonian Institution. Mr. Morris' past experience includes a wide and varied background in the performing arts.
- Mr. Donald Nicholas, who is currently the Deputy Director of the Virginia Museum of Fine Arts. His main activities are in the area of business management.

In addition to the project consultants, the liaison to the Project Officer, Mr. David Waterman, provided input into the process. Mr. Waterman is an economist at the National Endowment for the Arts.

A total of four meetings were held with the consultants and Mr. Waterman over a three-month period. After considerable deliberation by the Panel, the conclusion was that non-profit art organizations of all types considered maximize output subject to a profit constraint. Specifically, this is the maximization of attendance subject to a zero-profit constraint. Such a goal implies increasing attendance up to the point where total revenue (TR) is equal to total costs (TC).

Before describing the models developed relative to these objective functions, it is instructive to indicate in a general way the output-profit relationships associated with each objective function.

Figures 1 and 2 present simplified illustrations of these relationships:

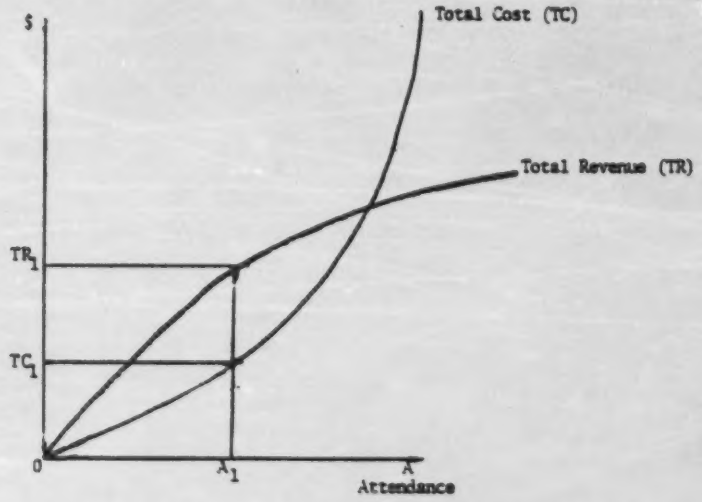

FIGURE 1: PROFIT MAXIMIZATION SOLUTION FOR THE INDIVIDUAL ORGANIZATION

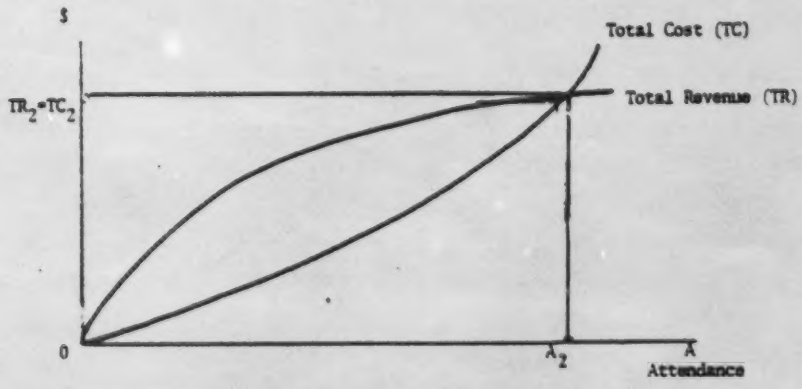

FIGURE 2: ATTENDANCE MAXIMIZATION WITH ZERO-PROFIT CONSTRAINT FOR THE INDIVIDUAL ORGANIZATION

Profit maximization implies a solution in Figure 1 where attendance is given by A_1. At this attendance level, profits are defined as $(TR_1 - TC_1)$. Attendance maximization with a "zero-profit" constraint implies a solution in Figure 2 where the attendance level is A_2, and the profit level is zero $(TR_2 = TC_2)$. In the first case, marginal revenue and cost are equal, while in the second case, total revenue and cost are equal. The introduction of grants, contributions, and endowment income can be treated as downward shifts in the cost curve or upward shifts in the revenue curve in Figure 2. The result of either shift is a new equilibrium point with greater attendance (still with zero profit) under conditions of attendance maximization with a zero-profit constraint.

B. The General Models

The models developed for the performing and visual arts organizations incorporated either a profit maximizing objective function or a constrained attendance maximizing objective function. In both cases the models include demand, supply, pricing and capital accumulation relationships. The objective function determines the solution set for each model.

Before turning to a discussion of the structural relationships developed for the general models, it is important to note that the relationships and variables specified here are of two types: (1) those based on general economic theory; and (2) those which are "institution-specific," i.e., those based on relationships defined by the structure of the arts and cultural industries. These "institution-specific" variables are used to reinforce the variables normally associated with general economic theory. Thus, for example, in the For-Profit Theater model, discussions with the Advisory Panel and other a priori information led us to believe that the demand function (measured by attendance) is not only a function of price and income variables, but is also dependent upon other variables specific to the Broadway theater, such as the

crime rate, strikes by transportation workers, etc. By including such variables in the general model, a more applicable relationship is achieved that will better approximate the actual relationship. Therefore, the discussions which follow include descriptions of the major behavioral relationships which exist in the general models with respect to both theoretical and institution-specific variables.

1. For-Profit Theater

The For-Profit Theater model contains five behavioral equations which determine demand, supply, pricing, capital accumulation and advertising expenditures. The specifications for each of the five equations include relationships based upon general economic theory, observations of arts organizations in general, and for Broadway theaters, specifically. The following discussion highlights the underlying considerations which serve as a foundation for the development of each of the behavioral relationships.

Quantity demanded in the For-Profit Theater model is measured by attendance. However, a given attendance level can be associated with various numbers of performances depending on the audience size per performance. Because of this, it was decided to standardize the demand measure by dividing attendance by the total number of performance seats available (i.e., seating capacity multiplied by the number of performances). The resulting measure is a utilization rate of the capacity of the theater. This utilization rate, as well as attendance, can be explained by price and income variables and by those variables peculiar to the For-Profit Theater industry.

The specification of the price variables was based on general theoretical considerations. The price of admission to the theaters is specified as being negatively related to attendance or to the utilization rate. This was based on the assumption that the product of the theater is a good, i.e., a decrease in the price of admission will, ceteris paribus, result in an increase in the quantity demanded. In the case of utilization rates, the inability of the

industry to increase the capacity of the theater without a considerable time loss, makes this assumption valid.

In addition to the price of admission, the price of complements was also included in the demand function for For-Profit Theater. These complements, such as the cost of babysitting, dining out, and transportation costs to the theater, combine to increase substantially the effective price of attending the theater. In fact, Baumol and Bowen calculated the cost of such complements as being at least equal to the price of admission to the theater. Thus, general theoretical considerations indicated that the prices of complements are negatively related to the utilization rate, since an increase in the effective price or total cost of admission to the theater results in a decrease in the quantity of output demanded, ceteris paribus. Likewise, the general model also includes the price of substitutes as a variable affecting the quantity of theater services demanded. Such substitutes include movies, Off-Broadway theater, television, etc. The price of these substitutes are specified as having a positive effect on the demand for Broadway theater. In other words, as consumers are faced with increasing costs for products which serve as substitutes for the legitimate theater, the quantity demanded of the product of For-Profit Theater will increase.

In addition to the movements along the demand curve resulting from changes in the price variables specified above, the general model also accounts for potential shifts in the demand curve. One set of variables that accounts for such shifts is income variables, which are measured in the model by total per capita income and the unemployment rate for the area. Per capita income was specified in the model as being positively related to the utilization rate and attendance. That is, an increase in the per capita income level results in increased utilization of For-Profit Theater, all else being equal. This specification is in keeping with general theoretical considerations. Thus, a change in the

income level of the population will serve to shift the demand curve to the right, which results in an increase in the quantity of the theater demanded (utilization) at all price levels. By the same token, the rate of unemployment has a positive effect on the demand. An increase in the general unemployment rate may serve to reduce the effective income of the population, and thus result in a leftward shift in the demand curve, but this effect would be captured by the income term. However, unemployment is also associated with a drop in the opportunity cost of time, and given that theater attendance is a relatively time intensive activity, the result is a decrease in the effective price of attending the theater.

In addition to variables based strictly on theoretical considerations, the demand function also includes other elements specifically related to the nature of the For-Profit Theater industry. For example, strikes by public workers, such as police, transportation, or sanitation personnel can have a dramatic effect on attendance and the utilization rate. These effects can be looked at from two points of view. First, in the short-run, a strike may serve to raise the cost of theatergoing, thus causing a reduction in the quantity demanded of the product. Over a longer period, on the other hand, strikes may affect the tastes of the consumer, resulting in a leftward shift in the demand curve. For example, a strike by the police may increase the fear of crime in the theater district.

The above discussion of the relationships in the demand function illustrates the increased sensitivity of the function by the inclusion of variables other than those based solely on theoretical considerations. By including industry-specific variables, it is felt that the equation more accurately portrays the actual relationships which exist in the For-Profit Theater industry. Similarly, this type of specification can be carried forward into other segments of the general model.

The supply of performances in the For-Profit Theater industry is represented in the general model by the cost-output

relationships, that is, costs are positively related to the number of performances. In other words, an increase in the number of performances per time period, ceteris paribus, leads to an increase in total costs. However, in the For-Profit Theater industry, the level of output is not easily measured, due to the inter-production heterogeneity of performances. To account for such heterogeneity, a scheme had to be devised to measure the overall level of output. Of course, no single aggregation scheme could fully account for all the heterogeneity present, but a good approximation was achieved by aggregating across productions and accounting for the major differences among performances, such as plays (non-musical/drama) vs. musicals, the size of the cast, and the length of run by using proportions and averages as separate standardizing variables in the specifications. Thus, it was hypothesized, for example, that the proportion of musicals would have a positive effect on the cost function, since in most cases more production personnel are required than for plays. Similarly, a smaller average cast size should decrease the costs of production whether musicals or not.

The cost function can also be affected by other variables that are industry-specific. For example, one variable that significantly affects the costs of production is wage increases that are different from productivity increases. Theoretically, increases in wages are normally associated with increases in labor productivity, so as productivity increases, wages increase proportionately. However, the theater industry is peculiar in this respect. Historically, increases in labor productivity have been slight, due to the nature of the industry. From this theory, a decline in the productivity in the theater industry relative to other industries should be accompanied by corresponding decreases in relative wages. If a relative decline in theater wages does not occur (and historically it has not), an increase in the cost of production in theaters relative to sectors experiencing productivity gains will result. As Baumol and Bowen point out, "for an activity such as the live performing arts where productivity is stationary, every increase

in money wages will be translated automatically into an equivalent increase in unit labor cost ..." (Baumol, W., and Bowen, W., Performing Arts - The Economic Dilemma (p. 171). Thus, the inclusion of a variable representing the upward pressure for wage increases by persons employed in the theater industry further refines the specification of the cost relationship.

The third behavioral relationship presented in the general model is the pricing mechanism. This mechanism is basically a cost-plus-markup, so that price depends on the average cost per person attending. That is, the price charged by For-Profit Theaters is proportionately related to the average cost (per attendee) of production. This behavior is consistent both with general economic theory and with the behavior as described by the expert consultant panel.

The last important relationship is the process of capital accumulation. The process is basically that of an economic accelerator model where the desired capital stock is related to the number of performances and the average utilization rate per performance, or the percentage change in attendance. Thus, if the number of performances and the utilization rate are high, the theater would be inclined to expand its seating capacity.[1/]

These four basic relationships comprise a system where equilibrium for the firm is the result of satisfying the objective function of profit maximization through the equality of marginal revenue and marginal cost. Such a solution is shown in Figure 1 at that level of attendance, A_1, where the slopes of the total revenue (TR) and total cost (TC) curves are equal, resulting in a profit level of $TR_1 - TC_1$.

2. Non-Profit Art Organizations

The general model for Non-Profit Art Organizations served as the basis for six separate models. These models are presented in Section V and represent: Non-Profit Theater,

1/ Individual theaters would, of course, normally do so in the short-run by changing theater and in the long-run by new construction, but the entire industry may be seen to adjust total capacity annually through the combined actions of many individual theaters.

Opera, Symphony, Ballet, Modern Dance, and Museums. The number of key behavioral relationships for each of these models varies from 11 to 19, including demand, supply, pricing, capital accumulation and the supply of unearned income. The specifics of each relationship, of course, included individual characteristics that were observed for the particular art form being studied. The objective function in each case was attendance maximization subject to a "zero-profit" constraint.

For each of the non-profit models, the demand function is measured by attendance or utilization with the same basic conditions and relationships discussed for the For-Profit Theater applying. In addition to the variables specified previously, however, the general model for non-profit organizations includes variables which are industry-specific. For example, an important component of the non-profit organization's attendance is comprised of subscriptions and memberships. Since the measure of total attendance includes unknown levels of "season ticket" holders, the general model for non-profit institutions includes either of two variables that attempt to account for the demand generated by subscriptions and memberships: the desired expansion of subscription sales, and the level of advertising committed by the organization for subscriptions and memberships. These two variables were considered to be highly related since an increase in desired expansion would be carried out in part by an increase in advertising expenditures. It was hypothesized that an increase in the level of advertising expenditures would have a positive effect on attendance and the average utilization rate, since successful promotional expenditures are expected to shift the demand curve to the right.

The determination of supply for non-profit organizations is again based on the cost-output relationship, and is almost identical to that developed for the For-Profit Theater. For all non-profit organizations except museums, the supply relationship is identical to the For-Profit Theater model. In the museum model, costs are broken down into their six component parts: (1) annual

expansion cost; (2) annual educational and other group programs' cost; (3) annual publications' cost; (4) annual cost for all auxiliary services; (5) annual cost of research activities; and (6) annual operating and production costs. Annual total costs then are simply the aggregation of these six components. Thus, no adjustments are necessary to account for the heterogeneity of output in the museum model. In addition, museums differ from other organizations in the magnitude of their capital costs. The museum industry is extremely capital-intensive relative to the performing arts organizations (which are labor-intensive).

The pricing scheme for Non-Profit Organizations exhibits a lag structure that is not found in For-Profit Theater. This, in large part, is due to the existence of significant sources of income other than the revenue from admissions, and the explicit goal of maintaining as low admission fees as possible in order to maintain and widen audience appeal. Therefore, changes in the costs of production and the demand conditions are not automatically translated into price changes. In most instances, attempts are made for cost changes to be wholly or partially absorbed by unearned income. However, persistent deficits are likely to lead to a revision of the pricing schedule.

The capital accumulation process is similar to that of the For-Profit Theater, being basically an accelerator principal, where desired capital is related to the number of performances and the utilization rate or the percent change in attendance. Additional capital expansion (or contraction) is thus related to the difference between desired capital and the actual capital stock (capacity).

The relationships discussed to this point are similar to those observed for For-Profit Theaters. But, the determination of the level of unearned income is unique to Non-Profit Art Organizations. Unearned income is derived from both private and public sources, with private sources being subsidized by the public sector in the form of tax deductions for the contributed

income. There has not been a study of these types of contributions solely for the arts because of data limitations, but studies have been conducted on philanthropic contributions in general. Two of the major studies in this area are those of R.A. Schwartz on philanthropic contributions (Schwartz, R.A., "Personal Philanthropic Contributions," Journal of Political Economy, December 1970 and Schwartz, R.A., "Corporate Philanthropic Contributions," Journal of Finance, June 1968). Using this background as well as the intensive discussion with the project consultants, the behavioral relationships established for private contributions included the volume of performances or exhibits by the organization, its pursuit of contributions via fund-raising activities, the incentives provided by the tax laws, and the selected wealth measures (e.g., stockholders' equity for all manufacturing corporations, Standard & Poor's common stock price index). All of these factors should be positively related to the level of contributions.

The case of the contributions provided by foundations is similar to that of private individuals and group, with the exception of the role of the tax incentive since foundations enjoy a tax-exempt status. A deficit-surplus fund was included in this relationship since foundations may provide aid to Non-Profit Arts Organizations during periods of financial difficulties. The remaining source of support is that of governmental agencies. These grants are related to the number of performances, past grants and contributions by governmental agencies, as well as the budget position of the agency. These factors should be positively related to the grants received.

It should be noted that many of these organizations have endowment funds. Restrictions are often set on the use of the endowment principal for operations with some exceptions in the case of capital gains. Thus, the most important consideration is the endowment income. This income can be thought of as a type of annual grant and can be combined with unearned income.

The solution set for the system defined by the above relationships is determined by the objective function of constrained attendance maximization. Since the constraint is one

of "zero-profits," a condition is imposed on the sum of earned income, unearned income and expenditures, such that its planned value is zero. Of course, the information upon which the plans are based is often incorrect or unattainable so that a non-zero sum is often the outcome, in practice. In any case, the planned solution set is represented in Figure 2 by the attendance level A_2. At this point, total revenue (income) equals total expenditures and attendance is maximized without incurring losses.

C. The Transition from General Models to Conceptual Models

Before discussing the specifics of individual models in Section V, an important point should be made about the developmental process of those conceptual models. While the underlying structure of the general models presented here were used as the basis of the conceptual models, the transition from the general models to the conceptual models was often hindered by data constraints. That is, although all-important relationships were specified in the general models, the lack of data in many areas may cause several structural modifications in the conceptual model in order to facilitate the estimation process.

IV. FINDINGS OF THE REVIEW OF EXISTING DATA SYSTEMS

A. Introduction

Several conceptual models are presented in Section V (below). Each of these models identifies a required set of data in order to attempt the estimation of the models' parameters. Briefly, these data fall into the categories of output and attendance measures, measures of the costs of production, the prices of admission, the level of accumulated capital and the rate of accumulation, and the various types of contributions and grants received by each arts and cultural organization. The For-Profit Theater model differs from the others in that data are not required for grants and contributions. It was also determined that the Museum model would be more demanding in terms of data requirements because of the greater variety of operation which they typically undertake.

A survey of the existing data systems for the performing and visual arts organizations relative to these models revealed three types of deficiencies:

- the data are missing for certain elements for the arts organizations in both cross-sectional and time-series data systems,
- the observations are sparse for certain elements in the case of time-series data systems, and
- the data are not always available for individual organizations; instead aggregates for the art form are given.

The causes for these three deficiencies can be traced to one or both of the following characteristics for art organizations:

- the impermanence of many art organizations. This impermanence was discussed previously by both J. Poggi, W. Baumol and W. Bowen in their respective studies.

  .. Jack Poggi described the commercial theater as an enterprise where "each production is a separate enterprise, with actors hired only for the run of the play... . Under this system the theater managers no longer produce plays, and the producers, for the most part, no longer have their own theaters." (Poggi, J., Theater in America: The Impact of Economic Forces, 1870-1967, p. 4)

.. W. Baumol and W. Bowen described the Off-Broadway theater organization as one that "consists to a considerable extent of fly-by-night companies and organizations which have never operated before and which, after the current production, will never be assembled again." (Baumol, W. and Bowen, W., Performing Arts-The Economic Dilemma, pp. 26-27)

- the lack of standard accounting procedures. This was also discussed by W. Baumol and W. Bowen in their study of the performing arts.

.. W. Baumol and W. Bowen described the dance company as an organization that is "Typically, ... administered in all aspects by a single person... . He either serves as his own secretary, accountant and business manager or entrusts these tasks to his wife or a friend." (Baumol, W. and Bowen, W., Performing Arts-The Economic Dilemma, pp. 26-27)

These two characteristics, impermanence of the organization, especially in the case of the For-Profit Theater, and lack of standardization in the accounting procedures, are currently being addressed by private organizations and governmental agencies. Two of the most prominent of these are the Ford Foundation and the National Endowment for the Arts. The Ford Foundation has undertaken the collection of data for arts organizations in the following five areas:

These two characteristics, impermanence of the organization and lack of standardization in the accounting procedures, are currently being addressed by private organizations and governmental agencies. Two of the most prominent of these are the Ford Foundation and the National Endowment for the Arts. The Ford Foundation has undertaken the collection of data for arts organizations in the following five areas:

- Non-Profit Theater
- Opera
- Symphony
- Ballet
- Modern Dance

The National Endowment for the Arts is currently supporting efforts of data collection and compilation, as well as the identification of data gaps and deficiencies.

During the process of creating data files for each of the seven separate types of arts and cultural institutions (mainly from the Ford Foundation data), a number of data deficiencies were encountered. While these deficiencies were severe enough to prevent the construction of usable data files in only two instances, the deficiencies were important enough to be reviewed in depth. The following discussion will deal separately with each art form, presenting the sources of the available data as well as identifying the missing data elements.

B. For-Profit Theater

The sources of the data for the For-Profit Theater are the Black Report (New York Cultural Council, A Study of the New York Theater); Baumol and Bowen (Baumol, W. and Bowen, W., Performing Arts - The Economic Dilemma); Moore (Moore, T.G., The Economics of the American Theater); and Poggi (Poggi, J., Theater in America: The Impact of Economic Forces). Data were also obtained from various issues of Variety Magazine.

The data deficiencies for this art form are the following:

1. There are no usable cost data. Although Moore performed a cost study, it resulted in only five observation sets. (Moore, T.G., The Economics of the American Theater, pp. 41-68, 155). They covered the following years:

- 1927/28, 1928/29
- 1939/40, 1940/41, 1941/42
- 1949/50, 1950/51
- 1954/55, 1955/56
- 1960/61.

Each of these observation sets gave the components of the following costs:

- average production costs
- average weekly operating costs, and
- total costs.

These five observation sets were adequate for Moore's purposes and represent the most comprehensive cost study of Broadway productions to date. However, the sparsity of the observations limits their usefulness in time series analysis.

2. There are no theater capacity data. This prevents the analyses of the expansion of Broadway theaters and utilization rates for these theaters. The only data available for capacity are those on the number of theaters.

3. There are no total attendance data for years prior to 1974. All the attendance data before 1974 refer to estimated average February figures only. The usage of February attendance as an indication of annual attendance assumes that seasonal variations in theater attendance are the same for each year in the time series.

4. There are no data for the individual organization or production company. This aggregation of the data prevents the usage of alternative aggregation schemes. If the data were available for the individual productions, it would be possible to experiment with various aggregates such as:

- aggregates based on length of run, and
- aggregates based on initial investment, capitalization.

These aggregations will also combine the breakdown by type of production; is it a play or a musical? Needless to say, many other aggregation schemes could be devised in order to analyze the workings of Broadway theaters. Finally, disaggregated data would make it possible to perform cross-sectional analysis for the various productions.

5. There are no data for revenue from movie-rights, recordings, or similar activities. This deficiency limits the analysis of Broadway activities and the expected returns from such activities. Thus, if this type of revenue and cross-sectional data were available, it would be possible to construct a model that is based on expected returns. In such a model, investors would not necessarily view the returns from Broadway activities as an

end in itself, but as part of the total returns which include movie-rights, etc. Such a model would have a greater explanatory power for the behavior of investors, playwrights, producers, etc.

6. There are no data on the wages of the artistic and non-artistic personnel on Broadway. Undoubtedly, such data could be found in the files of the relevant labor organizations, such as Actors' Equity. These data have not been obtained or published so far.

C. Non-Profit Theater

The source of the data for Non-Profit Theater is the Ford Foundation. This data set has (134) items for the following six areas:

- earned income: income derived from performances,
- unearned income: income derived from grants, contributions and various funds,
- balances of accumulated funds,
- salaries and fees for artistic and non-artistic personnel,
- non-salary costs such as equipment, royalties and transportation costs, and
- effective factors such as total output, total attendance, subscriptions sold, capacity and price structure.

The data span a period of nine years, 1965/66 through 1973/74.

This data set was edited by the Ford Foundation. The missing values were estimated on the basis of the assumption that "within each art form organizations with like total operating expenditure levels will have similar responses...", (The Ford Foundation, The Finances of the Performing Arts, Vol. I, Appendix G, p. 5). The percentage of lines of the survey questionnaire for which data were reported averaged over 90 percent for all art forms for the first six years of data collection. (The Ford Foundation, The Finances of the Performing Arts, Appendix G., p. 5.)

This data set represents an extensive data collection effort on the part of the Ford Foundation. It is the most comprehensive

set available for non-profit art organizations, and included a considerable editing effort over the nine-year period which it spans. This editing effort resulted in a consistent data set across years and the art organizations included.

The data deficiencies for this art form are the following:[1/]

1. There are no attendance data for contracted performances. The size of the audience for such performances influences their continuation. Therefore, if the attendance data were available, it would be possible to improve on the explanation for the variations in this income source.

2. There are no data for promotional activities directed toward increasing attendance. These selling costs should be investigated in order to determine their effect on attendance.

3. There are no breakdowns for performances in terms of plays or musicals, length of run, etc. The across-the-board aggregation results in a greater loss of information than need be the case. If such breakdowns were made, the analysis would account for the various types of productions.

4. There are no output measures that are associated with recordings, films, radio or television. The absence of such an output measure implies either ignoring this income component, or assuming the correlation of the unreported output measures with the reported ones.

5. There are no data for the individual private contributions and the incomes of the contributors. The availability of such data would aid in the study of contributions and the factors that influence them.

[1/] There are data deficiencies in the Ford Foundation data base for each of the art forms it covers, but this is certainly not the fault of the Ford Foundation. Had it not been for the extensive efforts of this organization, this study could not have been undertaken. This data base is by far the best encountered in this research effort.

6. The model estimation effort (see below) revealed the possibility of errors in the seating capacity measures. This was suggested by the performance of the equations in which the ratio of total attendance to total potential seating capacity is used as the dependent variable rather than total attendance. The results using this measure were not nearly as good as those when using total attendance as the measure of demand.

It should also be stressed that the limited number of years spanned by these data also restricts the model estimation effort. This was particularly the case for the estimation of simultaneous equation models. Parts of this data set have been updated with the addition of two more years of data by Touche-Ross. The additional years are 1974/75 and 1975/76, but the updating included only 21 of the Non-Profit theaters in the original Ford Foundation sample. This updating effort was undertaken for only 16 data items out of a total of 134 items. The sources of these additional observations are the Theater Communications Group Annual Fiscal Surveys.

The sixteen updated items are:

- total expenses and two expense components,
- total earned income and three of its components,
- total unearned income and six of its components,
- total income, and
- the number of seats.

These updates exclude total attendance, the price of admission, and the number of performances which rules out their usefulness in the econometric model estimation. Additional deficiencies were reported by Touche-Ross & Co., in the compatability of the Ford Foundation and the Theater Communications Group data. This became apparent to them when comparing the observations for the year which overlapped in both sets: 1973/74. Our observations confirm the incompatability of eight of the sixteen updates with the Ford Foundation base data. Clearly, the added observations did not continue the trends established

by the base data in these eight cases. The reason may be that slightly different data definitions were employed.

D. Opera

The data source for Opera is also the Ford Foundation. The data deficiencies are identical to those of the Non-Profit Theater. In addition, there is a deficiency in the data concerning the accumulation of endowments. Thus, it is not possible to identify increment(s) from one period's endowment to the next. Consequently, endowments had to be treated as exogenously determined in our modelling effort.

E. Symphony

The primary source of the data for Symphonies is, again, the Ford Foundation. Another data set was compiled by the Center for Policy Research based on the raw data supplied by the American Symphony Orchestra League. The deficiencies found in the Ford Foundation's data set include those stated in the discussions for the Non-Profit Theater and the Opera. In addition, the following deficiencies were noted in the Ford Foundation's data:

1. There are no data for the matching funds accounts for the Symphonies that participated in the Ford Foundation Symphony Program. These data are significant insofar as they led to a decrease in the size of the appropriations for operations. This decrease resulted from the transfer of part of the income of the organization to the matching funds accounts.

2. There are no data for the interest income which is derived from the Accumulated Matching Funds. There are also no data for the dividend income obtained from the Ford Motor Company stock trust fund. These data are significant since the receipts of the symphonies were altered during the period of the accumulation of the matching funds. In addition, these two income components were undoubtedly altered when the symphonies gained control of the two funds on June 30, 1976.

The data from the American Symphony Orchestra League compiled by the Center for Policy Research covers only 17 Symphonies out of the over 100 available, but spans 26 years (1949/50 through 1974/75). The portions of this set made available to Applied Management Sciences cover earned and unearned income, the endowments, the number of players, salaries, length of season, and ticket prices. The data items which were made available to Applied Management Sciences included no breakdowns for the various components of the grants and contributions which were received. In addition, no attendance figures were compiled. The only measure of output made available is an unweighted length of season measure. The Center for Policy Research did indicate, however, that a weighted measure of the number of concerts is being developed at this time. These deficiencies limit the usability of this data base. Thus, even though the earned income and price measures could be used to approximate an attendance measure, its accuracy would be seriously in doubt. Also, it is not clear whether or not the earned income includes contracted services and recordings income, both of which would upwardly bias the computed attendance measure.

F. Ballet

The source of the data set for Ballet is the Ford Foundation. The data deficiencies are identical to those of the Non-Profit Theater, described above.

G. Modern Dance

The source of the data set for Modern Dance is also the Ford Foundation. The data deficiencies include those identified for the Non-Profit Theater, but deficiencies also exist in the usable sample size and with reference to gaps in the data. The sample size deficiency became apparent when all organizations with less than nine years of data were deleted. This reduced the sample size from eight to three dance companies. Gaps in the data exist for the number of performances, total attendance, annual seating capacity, and earned income. These deficiencies ruled out any meaningful model estimation, since a sample of three dance companies is hardly representative of this art form. Furthermore, the existing gaps

in the data make the hypothesis testing for the estimated coefficients inadequate.

H. Museum

There are two museum data sets:

1. A time-series data set was compiled through the combined efforts of Applied Management Sciences and the Center for Policy Research which is based on the income and financial statements obtained from fourteen museums. This involved the analysis of the individual income and/or balance sheet statements to identify the entries to be used in constructing income, expenditures, and the several funds variables for the museums. The following deficiencies were identified for this data set:

   a. There is a lack of standardization for the income and financial statements of museums. This lack of standardization is also observed when comparing the statements of the same museum from year to year. The observed deficiencies stem from changes in the data included under a heading and changes in the breakdowns for various categories. These deficiencies lead to considerable difficulties in setting up time series data files for museums under the present contract. Similar conclusions were presented by the National Research Center of the Arts in its data collection effort Museums USA: A Survey Report. This study states that the museum industry is literally unable "to make a proper financial accounting of itself." (p. 491)

   b. There are no adequate data for the components of earned income. These data should provide information for the sources of the earned income. Some of these sources would be membership dues, admission fees and donations, charges for attending educational programs, sale of publications, and auxiliary services. This deficiency hinders the analysis of

earned income since the mix of these income components is likely to change over time, whereas the data do not indicate that mix.

c. There are no consistent data for the unearned income components. The available data often disaggregate grants and contributions by source, but at other times revise the disaggregation scheme altogether. This inconsistency prevents the analysis of the components of unearned income.

d. There are no consistent and sufficiently disaggregated expenditures data. The data should supply information regarding the costs of accessions, educational programs, publications, research, fund-raising and promotional activities, auxiliary services and general operations. The deficiencies in these cost data should be remedied in conjunction with the earned income components. This would help in relating the various costs and incomes so that the operations of the museums can be analyzed.

e. There are no adequate data for the various funds for museums. This is actually an extension of the lack of standardization. The available data for museums' funds are not often specific with reference to the purpose of the fund. Thus, accession funds might exist for a museum, but no such identification is associated with them. The same is true for other funds. This deficiency hinders the analyis for the relationships of the various funds and the specific operations of museums.

f. There are no adequate data regarding the "output" of museums. Such output could be measured, for example, in terms of hours of operation, number of exhibits, cost of exhibits, or square feet of

exhibit area. The absence of such output measures hinders the estimation of econometric models developed below for museums.

g. There are no adequate data for the stock of exhibit items, deaccessions, and the utilization rate of the available stock. This deficiency hinders the analysis of capital accumulation, accessions and construction or acquisition of facilities.

In general, the time series data for museums were inconsistent and at times limited to total receipts and expenditures.

2. A cross-sectional data set was obtained from the National Research Center of the Arts. This group undertook a survey of museums under the auspices of the National Endowment for the Arts, the results of which are reported in Museums USA: A Survey Report. The universe for this study consisted of 1821 museums which:

- have permanent facilities which are open to the public on regular basis,
- are open for a minimum of both three months a year and 25 hours a week for a three month period,
- own part or all of the collection exhibited, are non-profit tax-exempt institutions,
- have at least one full-time paid employee with college or special training related to the museum operation, and
- have a minimum operating budget for fiscal year 1971/72 (excluding capital improvements or accumulations) of $1,000 per month.

The National Research Center of the Arts selected a sample of 728 museums from the universe of 1821. This sample is representative in terms of type and region, but since different sampling proportions were used for the larger museums, they are over-represented in this sample.[1/] The data were collected for the fiscal year ending in June of 1972, unless the museum's fiscal year coincided with the calendar year in which case data for the year ending in December of 1971 were acquired.

1/ The National Research Center for the Arts did apply a statistical correction factor to the data that they report, but it is unknown if the data received from them on magnetic tape were so corrected.

This survey represents a major step in data collection for museums, but suffers from several important deficiencies:

- The only measure of output that could be constructed from the available data is based on the number of hours the museums are open. Alternative measures, such as the total number of exhibits for the year, or the square footage of the exhibit area would have been of great help.
- Data on the costs of museum auxiliary services, such as restaurants and parking lots, are not identifiable. This rules out full analysis of these services, which are very important to museums because of the significant revenue which they generate.
- Data on costs are not segregated in terms of free admission programs and those for which a fee is charged. The mix of these programs depends on the museums' financial situations and the other sources of income, both earned or unearned.
- Data on the stock of exhibit items do not exist even though the rates of utilization of that stock are given. These data are relevant in the evaluation of the capital accumulation process and in the prediction of the levels of output.
- There are no output measures for publications, such as circulation counts. This type of activity generates a significant level of revenue from advertising and subscriptions, as well as serving as an effective promotional device.
- The output of and returns from research operations are not reported, although the cost of research is.
- The membership count data proved to be inadequate for the model estimation. This is likely the result of the use of ten pre-selected intervals for measuring this variable, rather than the actual count.

Finally, the cross-sectional nature of this data base lessens its value for model estimation purposes. Since it is a single period cross-section, functions which require lagged values of or changes in endogenous variables could not be estimated (at least not with lagged values or changes). Also, the use of such disaggregate data introduces the problem of heterogeneity of the units of analysis. With time series data, data heterogeneity is not a serious problem as long as the composition of the observations from which the aggregated observations were derived does not change drastically over time. With cross-sectional data, however, aggregation cannot

be used to escape the problem of heterogeneity. Either the analysis has to be limited to general characteristics, or run separately on each homogenous subset.[1/]

[1/] This latter alternative is not within the scope of work of the present effort.

RECOMMENDATIONS

The two main causes of deficiencies in the existing data systems were identified as the impermanence of For-Profit art organizations and the lack of standardization in the accounting procedures for these and other organizations. Efforts are underway at this time by private organizations and governmental agencies to remedy these causes. For example, the support of the Ford Foundation and the National Endowment for the Arts has certainly led to some stabilization of the various industries and some effort has been made to develop accounting guidelines (e.g., Museum Accounting Guidelines), ed. Victor Danilov, Association of Science-Technology Centers, Wachington, D.C., 1976; published as a result of a grant from the National Endowment for the Arts). The continuation of such efforts by these organizations and agencies should lead to data systems that would be more adequate for modelling and forecasting efforts. It is, therefore, recommended that organizations such as the Ford Foundation and agencies such as the National Endowment for the Arts continue and expand their roles in these areas. Specific recommendations for improvement of the data bases applicable to the several types of arts and cultural organizations are described below:

For-Profit Theater

1. The sparsity of the cost data for the For-Profit Theater ruled out the estimation of the supply and pricing relationships in the conceptual model. This data deficiency could be remedied by an effort similar to that of T.G. Moore, who analyzed the costs for samples of Broadway plays and constructed cost data for five periods, 1927/28-1928/29, 1939/40-1941/42, 1949/50-1950/51, 1954/55-1955/56, and 1960/61. (Moore, T.G., The Economics of the American Theater, pp. 41-68, 155). The availability of financial records for other time periods should be investigated in order to construct a longer time series for cost data.

2. The lack of capacity data for the For-Profit Theater limited the demand analysis to that of annual total attendance, since the utilization rate could not be computed. Furthermore, it was not possible to estimate the capital accumulation process in the conceptual model because of this deficiency in the capacity data. This deficiency could be corrected from the available records for the theaters on Broadway. It is quite unlikely that the highly centralized operations for Broadway, which prevailed during the first half of this century under the Syndicate and later the Shubert Brothers, did not yield adequate capacity data. In addition, given that the number of theaters on Broadway is available for the years 1927-1960, 1963, one would expect records concerning the seating capacity of these theaters to be available.

3. The deficiency in the wage structure data for artists on Broadway could be partially corrected through the records of Actors' Equity and other labor organizations.

4. The data deficiencies in the areas of total attendance, individual productions by a company, and the secondary, but quite important, sources of income such as movie-rights and recordings, are more difficult to remedy. It is quite likely that past records for these variables are either unavailable or quite costly to obtain. Thus, an effort should be made to collect these data for the current and recent periods. It should be pointed out that Variety magazine is currently publishing the total attendance data. In addition, data could be obtained regarding individual productions and the secondary sources of income from Variety magazine and other similar publications.

Non-Profit Organizations (Excluding Museum)

1. The main deficiency of the Ford Foundation study of non-profit art organizations (Non-Profit Theater, Symphonies, Ballet, Modern Dance and Opera) is the small number of observations and the fact that it is not up-to-date. This data base was skillfully prepared, but this deficiency greatly influenced the method, extent,

and content of the analysis. An effort was undertaken by Touche-Ross (to add observations for two years, from data held by the Theater Communications Group, to 21 of the Non-Profit Theaters in the Ford Foundation study) in order to improve this part of the Ford Foundation data base. Unfortunately, the linking of the additional years of data produced significant discrepancies in half of the sixteen variables. Since the Ford Foundation data were heavily edited, this suggests that any data used to update this data base be similarly edited. In any event, the few data items that were updated was surprising. The lack of data for attendance, price, and the number of performances is difficult to justify given the availability of data on revenue, cost, and seating capacity. These data are certainly available but have not been compiled. Therefore, the continuation of this data collection effort for all organizations which participated in the Ford Foundation study should be encouraged. Because the Ford Foundation data set is the most comprehensive and consistent data set available, and since the costs of this undertaking are considerable, governmental subsidies should be considered.

2. Specific attention should be given to the Modern Dance component of the Ford Foundation data base. The data deficiencies for Modern Dance ruled out any meaningful statistical estimation of the conceptual model. These deficiencies were the result of the small universe size of the Modern Dance Companies with budgets of over $100,000 and the size of the data gaps for some of the variables. An effort should be made to obtain the missing data and to expand the sample size. This task is likely to be difficult since the data for dance companies are most likely to suffer from both the impermanence of the organization and the lack of standardization in the accounting procedures.

3. The American Symphony Orchestra League data are particularly rich in detail and numbers of symphonies, and rival the Ford Foundation data base in potential value. Only a small part of these data (both in terms of numbers of symphonies and numbers of variables) were made available to Applied Management Sciences for

this study, but, from these data, it was nevertheless clear that a thorough and detailed editing of all these data should be continued. It is therefore recommended that this be considered as a major component of any data base development activities.

Museum

1. The data for the museums time series could be improved significantly if the accounting procedures used to construct the income and financial statements of the various museums were standardized.

2. The museum cross-sectional data could be improved by expanding the time period to more than one year. This mix of time series and cross-sectional data introduces past information for museums' operations and their adjustments to changing economic conditions. Since such an annual survey is costly, a subset of the sample (e.g., all sampled art museums) could be considered. This data set could also be improved by supplementing the available data with data on the total number of exhibits for the year, the square footage for the exhibit area, the various components of expenditures, the stock of exhibit items, and measures of output for activities such as publications and research. In any event, it would be just as useful and certainly more cost-effective (but would also take longer) to concentrate on a small (but statistically representative) subset of museums and collect data over time on them.

V. CONCEPTUAL ECONOMETRIC MODELS

A. Introduction

The general models were presented in Section III, while the review of existing data was presented in Section IV. The purpose of this section, therefore, is to present the conceptual models for each of the several types of cultural institutions as developed from the general models of Section III and in light of the data constraints of Section IV. Obviously, a number of compromises had to be made and some specifications may appear to be "incomplete," but these models were developed for immediate estimation and not as end products.

The specification for each behavioral equation contains the full listing of potential measures which may be used. That is, many of the variables listed in a given specification are alternative measures and are not necessarily suggested as appearing in the estimated equation at the same time. Not only would degrees of freedom problems prevent such an attempt, but economic theory quickly demonstrates the inappropriateness of such action.[1/]

B. The Conceptual Models

In total, a series of six conceptual models are presented in this section. These models are:

- For-Profit Theater
- Non-Profit Theater
- Opera
- Symphonies
- Ballet
- Dance[2/]
- Museum

1/ Of course, the simultaneous use of alternative measures of the same phenomena would also introduce substantial simultaneity into the estimation process, so that all but one alternative would be dropped as a statistical matter in any event.

2/ A model is suggested for Dance even though the data are insufficient to estimate such a model.

1. For-Profit Theater

The objective function of the For-Profit Theater is profit maximization. This objective function is incorporated in the conceptual model by producing the level of output and performances, in which the increments to total revenue are equal to the increments to total costs.

The conceptual model is composed of five behavioral relationships representing demand, supply, pricing, capital accumulation, and advertising. The demand relationship is measured by either attendance or capacity utilization, where the size of the audience is related to price and income variables as well as such variables as might affect the effective price or shift the demand curve. The supply relationship is based on the cost of production. The pricing relationship is presented as cost-plus markup, which relates the price of admission to the cost per person attending the theater. The capital accumulation relationship is that of an accelerator model, where increases in the utilization rate and the number of performances lead to increased capital accumulation. The advertising relationship is a function of the average utilization rate since this rate is an indication of the demand level. These four relationships define the workings of the For-Profit Theater's model. Equilibrium is achieved as a result of the fulfillment of the objective function, since at the point of maximal profit no incentive exists for the expansion or contraction of operation.

The conceptual model is presented in Table 1 while Table 2 provides a list of the variables used in the model.

Equation (1) defines revenue as the product of the price of admission and attendance. The cost function, shown in Equation (2), is dependent on the output level. Since the output in the present model is not homogeneous, indicators are included that account for the existing heterogeneity. These indicators are: (1) percentage of shows that are musicals, (2) average cast size, (3) average length of time productions have been in operation,

and (4) the type of reviews the play received. The quantity demanded is measured by attendance or utilization level. Equation (3.1) shows total attendance as a function of price, total capacity for the season, advertising expenditures, disposable income of the population in the area, the unemployment rate for the population most likely to attend the theater, and the crime rate for the area. In this case, the utilization rate is calculated as the quotient of total attendance and annual performance capacity. Equation (4) defines annual performance capacity as the product of total capacity for all theaters and

TABLE 1: FOR-PROFIT THEATER - CONCEPTUAL MODEL

(1)	$R = A \cdot P$
(2)	$C = f(Q;H_1,H_2,H_3,H_4,D2,CMPHR)$
(3.1)	$A = f(P,Z,Adv;PC1,PC2,PS,YD,Um,Crm,ST,SS,SP)$
or	
(3.2)	$A = AU \cdot Z$
(4)	$Z = Cty \cdot Q/T$
(5.1)	$AU = A/Z$
or	
(5.2)	$AU = f(P,Q,Adv;PC1,PC2,PS,YD,Um,Crm,ST,SS,SP)$
(6)	$P = F(AC \cdot Q/A)$
(7)	$AC = C/Q$
(8)	$MR(Q) = dr(R)$ (dr: derivative)
(9)	$MC(Q) = dr(C)$
(10)	$MR(Q)-MC(Q) = 0$
(11)	$Cty = Cty_{-1} + \Delta Cty$ (subscripts indicate lags)
(12)	$\Delta Cty = XCty_{-1} - Cty_{-1}$
(13)	$X = f(Q/T,AU,Q/MQ,PDA)$
(14)	$XCty = Cty \cdot X$
(15)	$Adv = f(AU)$
(16)	$PDA = (\Delta A/A) \cdot 100$
(17)	$\Delta A = A-A_{-1}$

TABLE 2: FOR-PROFIT THEATER - ENDOGENOUS AND EXOGENOUS VARIABLES

Endogenous Variables

A:	annual attendance for all theaters
ΔA:	change in annual total attendance for all theaters
AC:	average per performance cost
Adv:	annual total advertising expenditures by all theaters
AU:	average utilization rate per performance
C:	annual total cost for all theaters
Cty:	total seating capacity for all theaters
ΔCty:	change in seating capacity for all theaters
MC(Q):	marginal cost per performance
MR(Q):	marginal revenue per performance
P:	average price of admission
PDA:	percentage change in the annual total attendance for all theaters
Q:	number of performances
R:	annual total revenue for all theaters
X:	total capacity expansion factor
XCty:	desired seating capacity for all theaters
Z:	annual performance capacity

Exogenous Variables

CMPHR:	compensations per hour in the private non-farm sector
Crm:	crime rate for the area
D2:	a dummy variable for the periods when artistic personnel go on strike
H_1:	percentage of musical shows in total production
H_2:	average size of cast
H_3:	length of time production has been in operation; this could be in weeks, months ...
H_4:	This is a dummy variable with a (1) for favorable reviews and a (0) for unfavorable ones. We could use a grading system, but this would cause a loss of too many degrees of freedom
MQ:	maximum attainable number of performances
PC1:	an index of the price of transportation within the relevant area
PC2:	an index of the price of services within the relevant area
PS:	price of substitutes such as other types of the performing arts and the mass media
SP:	an indicator for labor strikes for policemen in the area
SS:	an indicator for labor strikes for sanitation workers in the area
ST:	an indicator for labor strikes for transportation workers in the area
T:	number of theaters
Un:	unemployment rate of the population (white collar workers)
YD:	disposable income of the population in the area

the average number of performances for the year per theater. Alternatively, equation (5.2) shows the average utilization rate as the quantity demanded, which is a function of price, performances per year, total advertising expenditures, disposable income, unemployment, and the crime rate. Attendance in this case is determined from equation (3.2) as the product of average utilization and the annual performance.

The price of admission, specified in equation (6), is a function of the average cost per attendee. This approach is basically a cost-plus-markup pricing. Equation (7) defines the average cost per performance for all theaters as the quotient of the total costs of production and the number of performances. Equations (8) and (9) describe marginal revenue and the marginal cost, which are set equal to each other in equation (10), since the condition for profit maximization is the equating of marginal revenue and marginal cost. This period's capacity is defined in equation (11) as last period's capacity plus the change in capacity. The change in capacity is defined in equation (12) as the difference between last period's desired and actual capacities. The capacity expansion factor is expressed in equation (13) either as a function of the number of performances per theater, or as a function of average utilization rate and the proportion of maximum attainable output realized or as a function of the percent change in attendance. Equation (14) defines the desired seating capacity as the product of current capacity and the expansion factor. Equation (15) describes annual total advertising expenditures as a function of the average utilization rate.

2. Non-Profit Theater

The objective function for the Non-Profit Theater is constrained attendance maximization such that total receipts are equal to total expenditures. The total receipts for these theaters are composed of both earned and unearned income. Earned income is derived from admission charges, while unearned income is the sum of grants and contributions from both public and private

sources. The level of earned income is dependent on attendance and the price of admission. The demand function relates either attendance or utilization to price and income variables, as well as to those variables influencing the effective price of attending the theater and/or shifting the demand curve. The price function exhibits a lag structure which accounts for its rigidity, and price adjustments take place only as the costs of operations (net of unearned income) change.

The unearned income is derived from four sources, two of which are public and two of which are private. The public sources of income are Federal, state, and local agencies, while the private sources are corporations, individuals, and foundations. It is hypothesized that different factors affect the grants obtained from these four sources, with the expectation that some similarities exist in the factors that determine public grants.

The capital accumulation for the Non-Profit Theater is based on an accelerator model, where the utilization rate or the percent changes in attendance, etc. determine the expansion or contraction of the seating capacity.

The conceptual model for Non-Profit Theater is presented in Table 3, while Table 4 provides a list of the variables used in the model.

The demand for theater seats can be increased in two alternative ways. Equation (1.1) shows average utilization as a function of price, annual performance capacity, the desired expansion of subscription sales, disposable income of the population in the area, unemployment rate, as well as promotional activities by the theater and the crime rate. When using this demand function, attendance is the product of average utilization rate and annual performance capacity as in equation (2.1). Alternatively, equation (1.2)

BEST COPY AVAILABLE

TABLE 3: NON-PROFIT THEATER - CONCEPTUAL MODEL

(1.1) $AU = f(P,Z,SAdv,W;PC1,PC2,PS,YD,YDT,Um,Crm)$

or

(1.2) $A = f(P,Z,SAdv,W;PC1,PC2,PS,YD,YDT,Um,Crm)$

(2.1) $A = AU \cdot Z$

or

(2.2) $AU = A/Z$

(3) $Z = Cty \cdot Q/T$

(4) $C = f(Q;H_1,H_2,H_3,H_4,MW,CMPHR)$

(5) $P = f(NC,NCA,NCA_{-1},DSFR,P_{-1})$ (subscripts indicate lags)

(6) $NC = C-G+TAdv$

(7) $DSF = DSF_{-1}+\pi$

(8) $\pi = R-NC$

(9) $R = P \cdot A-\beta \cdot SBr \cdot Q \cdot P/T$

(10) $G = GF+GR+CPr+GFn$

(11) $GF = f(Q,A;GF_{-1},BNEA,GNP)$

(12) $GR = f(Q,A;GR_{-1},BNEA_{-1},PDGNP)$

(13) $CPr = f(A,\frac{A}{pop},CAdv;CAdv_{-1},t,SE,BTPR,ATPR,SPI)$

(14) $GFn = f(A,X,DSFR,DSF,Q,\Delta Cty)$

(15) $0 = R(Q)-C(Q)+\pi_{-1}+G_{-1}-TAdv$

(16) $Cty = Cty_{-1}+\Delta Cty$

(17) $\Delta Cty = XCty_{-1}-Cty_{-1}$

(18) $X = f(AU,Q/MQ,PDA,Q,Q/T)$

(19) $XCty = X \cdot Cty$

(20) $SAdv = f(W,Q;DSF_{-1})$

(21) $CAdv = f(\Delta OG_{-1},DSF_{-1},DSFR,Q,CPr_{-1})$

(22) $TAdv = SAdv+CAdv$

(23) $\Delta OG = (G-CPr)-(G-CPr)_{-1}$

(24) $W = XSbr-SBr_{-1}$

(25) $XSbr = \alpha \cdot Cty_{-1}$

(26) $Sbr = f(SAdv,P;Sbr_{-1},Tr)$

(27) $NCA = NC/A$

(28) $DSFR = DSF/(R+G)$

(29) $PDA = (\Delta A/A) \cdot 100$

(30) $\Delta A = A-A_{-1}$

(31) $\Delta Q = Q-Q_{-1}$

BEST COPY AVAILABLE

TABLE 4: NON-PROFIT THEATER - ENDOGENOUS AND EXOGENOUS VARIABLES

Endogenous Variables	
A:	annual attendance for all theaters
ΔA:	change in annual attendance for all theaters
AU:	average utilization rate per performance
C:	annual total cost for all theaters
CAdv:	advertising expenditures for soliciting private contributions by all the theaters
CPr:	annual private contributions
Cty:	total seating capacity
ΔCty:	change in seating capacity
DSF:	a deficit-surplus fund for operations
DSFR:	the ratio of the surplus-deficit fund to the operating budget
G:	annual total grants and contributions to non-profit theaters
GF:	annual federal grants
GFn:	annual grants by foundations
GR:	annual grants from regional agencies
NC:	annual net cost for all theaters
NCA:	net cost per attendee
ΔOG:	change in annual total grants net of annual private contributions
P:	average price of admission
PDA:	percentage change in the annual attendance for all theaters
Q:	number of performances
ΔQ	change in the number of performances
R:	annual revenue
SAdv:	advertising expenditures for the promotion of subscriptions' sales by all the theaters
Sbr:	actual level of subscriptions
TAdv:	total advertising expenditures by all the theaters
W:	the desired expansion of subscription sales
X:	total capacity expansion factor
XCty:	desired seating capacity
XSbr:	desired level of subscriptions
Z:	annual performance capacity
*:	surplus revenue

TABLE 4: (Continued)

Exogenous Variables:	
ATPR:	the ratio of profits after income tax to stockholders' equity for all manufacturing corporations
BNEA:	annual appropriations by the National Endowment for the Arts
BTPR:	the ratio of profits before income tax to stockholders' equity for all manufacturing corporations
CMPHR:	compensations per hour in the private non-farm sector
Crm:	crime rate for the area of interest
GNP:	gross national product
H_1:	percentage of musical shows in total production
H_2:	average size of cast
H_3:	length of time production has been in operation, weeks, months ...
H_4:	this is a dummy variable with a (1) for favorable reviews and an (0) for unfavorable ones. We could use a grading system, but this would cause a loss of too many degrees of freedom
MQ:	maximum attainable number of performances
MW:	a minimum wage index
PC1:	an index of the price of transportation within the relevant area
PC2:	an index of the price of services within the relevant area
PDGNP:	percentage change in gross national product
Pop:	the population of the region of interest
PS:	price of substitutes such as other types of the performing arts and the mass media
SE:	stockholders' equity for all manufacturing corporations
SPI	Standard & Poor's common stock price index
T:	number of theaters
t:	average tax rate for the contributors
Tr:	trend variable
Um:	unemployment rate of the population in the area of interest
YD:	per capita disposable income of the population in the area
YDT:	total disposable income of the population in the area
α:	historically-derived ratio of subscription to capacity
β:	the discount rate for subscription price

shows total attendance as a function of the same variables, as utilization in equation (1.1), but average utilization is the quotient of attendance and annual performance capacity according to equation (2.2). Equation (3) defines annual performance

capacity as the product of total capacity and the average number of performances for the year per theater. The cost function, shown in equation (4), is identical to that for For-Profit Theaters.

Equation (5) shows the price level as a function of the lagged net cost per person attending, the ratio of the deficit-surplus fund to the annual operating budget, and last period's price level. Net cost is defined in equation (6) as the cost of producing performances net of grants, but including advertising expenditures. Equation (7) specifies the deficit-surplus fund as incremented by the surplus revenue, where surplus revenue is defined in equation (8) as the difference between revenue and net costs. Equation (9) shows revenue as the product of the average price of admission and attendance less the discount for subscription patrons.

The grants received by the organization are separated according to their source. As shown in equation (10), public grants are divided into Federal grants and regional agencies' grants, whereas private grants and contributions include those from individuals, corporations, and foundations. Equations (11) and (12) show public grants as a function of the level of output, annual attendance, the previous period's grants, lagged and current budget for the NEA, and gross national product. Private contributions, as shown in equation (13), depend on the level of the activity for the theater, promotional activities, the marginal tax rate faced by the contributors, stockholders' equity for all the manufacturing corporations, profits before and after income tax, and a common stock price index. Equation (14) specifies grants from foundations as depending on the success of the theater seeking them and its zeal in such pursuit. The success measure is attendance, while its zeal depends on its plans for expansion and the rates of the deficit-surplus fund to annual revenue and grants, as well as output and the change in capacity. Equation (15) shows that the theaters in this group operate under a zero-profit constraint. This constraint is based on revenue from attendance, last period's grants

and surplus revenue less the costs of operation. This gives the output level which fulfills the constraint.

Equations (16) and (17) are definitional. Total seating capacity at a point in time is defined in equation (16) as last period's capacity plus the change in capacity. The change in capacity is the difference between last period's desired and actual capacities, as shown in equation (17). Equation (18) specifies the capacity expansion factor (i.e., the proportional change in capacity desired) as a function of the number of performances per theater, the average utilization rate, the proportion of maximum attainable output realized, change in attendance, and output. Desired seating capacity is defined in equation (19) as the product of actual capacity and this expansion factor.

Advertising expenditures play an important role in the operations of the Non-Profit Theater. As shown in equation (20), advertising expenditures for the promotion of subscription sales are dependent on the desired expansion of subscription sales, the number of performances, and last period's deficit-surplus fund level. Advertising expenditure for soliciting private contributions, presented in equation (21), are related to last period's change in annual total grants net of private contributions and last period's deficit-surplus fund, as well as last year's private contributions. Total advertising expenditures in equation (22) are simply the aggregation of expenditures for subscription sales and for the solicitation of private contributions.

Equation (23) specifies the change in annual non-private grants as the difference between current and last period's annual total grants net of private contributions. The desired expansion of subscription sales is defined in equation (24) as the difference between the desired level of subscriptions and last period's actual level of subscriptions. Equation (25) defines the desired level of subscriptions as an historically derived proportion of last

period's total seating capacity. Equation (26) shows that the actual level of subscriptions depends on current advertising expenditures for subscription sales, average price of admission, last period's subscription level, and a trend variable.

3. Opera

The objective function for the Opera is constrained attendance maximization. The constraint is "zero profits" which means that attendance is increased up to the point where planned profits are zero (i.e., where planned total receipts are equal to planned total expenditures).

The total receipts for the Opera are composed of both earned and unearned income. Earned income is derived from admission charges, while unearned income is the sum of grants and contributions from both public and private sources. These two types of income, as well as expenditures and capital accumulation, are discussed in detail for the Non-Profit Theater model, above. The difference between the Non-Profit Theater and the Opera is the significance of the endowment funds for the Opera. These funds are often restricted so that the organizations may use the endowment income, and possibly the capital gains from the endowment, to offset the cost of operations. However, the principal of the endowment is not usually accessible for the organization.

The conceptual model for Opera is presented in Table 5, while Table 6 provides a list of the variables used in the model.

Demand can be measured in two ways. Equation (1.1) measures demand as the average utilization rate, which is dependent on price, annual performance capacity, the desired expansion of subscription sales, disposable income of the population in the area, the unemployment rate, and the crime rate for the area, as well as certain promotional activities by the operas. In this case, total attendance is defined in equation (2.1) as the product of the

BEST COPY AVAILABLE

TABLE 5: OPERA - CONCEPTUAL MODEL

(1.1) $AU = f(P,Z,SAdv,W;PC1,PC2,PS,YD,YDT,Um,Crm)$

or

(1.2) $A = f(P,Cty,SAdv,W,Z;PC1,PC2,PS,YD,YDT,Um,Crm)$

(2.1) $A = AU \cdot Z$

or

(2.2) $AU = A/Z$

(3) $Z = Cty \cdot Q/T$

(4) $C = f(Q;CMPHR)$

(5) $P = f(NCA, NCA_{-1}, DSFR, P_{-1})$ (Subscripts indicate lags)

(6) $NC = C - YE - G + TAdv$

(7) $YE = i \cdot E$

(8) $DSF = DSF_{-1} + \pi^{*}$

(9) $\pi = R - NC$

(10) $E = E_{-1} + \Delta E$

(11) If DSF>0, then $\Delta E = DSF$ & $DSF = o$
otherwise $\Delta E = 0$

(12) $R = P \cdot A - \beta \cdot Sbr \cdot Q \cdot P/T$

(13) $G = GF + GR + CPr + GFn$

(14) $GF = f(Q,A;\ GF_{-1}, BNEA, GNP)$

(15) $GR = f(Q,A;\ GR_{-1}, BNEA_{-1}, GNP)$

(16) $CPr = f(A, \frac{A}{Pop},\ CAdv;\ CAdv_{-1}, t, SE, BTPR, ATPR, SPI)$

(17) $GFn = f(A,X,DSFR,DSF,Q,\Delta Cty)$

(18) $0 = R(Q) - C(Q) + \pi_{-1} + G_{-1} - TAdv + YE_{-1}$

(19) $Cty = Cty_{-1} + \Delta Cty$

(20) $\Delta Cty = XCty_{-1} - Cty_{-1}$

(21) $X = f(AU, Q/MQ, PDA, Q, Q/T)$

(22) $XCty = Cty \cdot X$

(23) $SAdv = f(W,Q;DSF_{-1})$

(24) $CAdv = f(DSF, DSFR, \Delta Q;\ \Delta OG_{-1}, CPr_{-1})$

(25) $TAdv = SAdv + CAdv$

(26) $\Delta OG = (G-CPr) - (G-CPr)_{-1}$

(27) $W = XSbr - SBr_{-1}$

(28) $XSbr = \alpha \cdot Cty_{-1}$

(29) $Sbr = f(SAdv,P;Sbr_{-1},Tr)$

(30) $NCA = NC/A$

(31) $DSFR = DSF/(R+G)$

(32) $PDA = (\Delta A/A) \cdot 100$

(33) $\Delta A = A - A_{-1}$

(34) $\Delta Q = Q - Q_{-1}$

TABLE 6: OPERA - ENDOGENOUS AND EXOGENOUS VARIABLES

Endogenous Variables:

A:	annual attendance
ΔA:	change in annual attendance
AU:	average utilization rate per performance
C:	annual total cost
CAdv:	advertising expenditures for the soliciting of private contributions
CPr:	annual private grants
Cty:	total seating capacity
ΔCty:	change in seating capacity
DSF:	a deficit-surplus fund for operations
DSFR:	The ratio of the surplus-deficit fund to the operating budget
E:	endowment
ΔE:	change in endowment
G:	annual total grants
GF:	annual federal grants
GFn:	annual grants by foundations
GR:	annual grants from regional agencies
NC:	annual net cost
NCA:	average net cost per attendee
ΔOG:	change in annual total grants net of annual private contributions
P:	average price of admission
PDA:	percentage change in annual attendance
Q:	number of performances
ΔQ:	change in the number of performances
R:	annual revenue
SAdv:	advertising expenditures for the promotion of subscriptions' sales
Sbr:	actual level of subscriptions
TAdv:	total advertising expenditures
W:	the desired expansion of subscription sales
X:	total capacity expansion factor
XCty:	desired seating capacity
XSbr:	desired level of subscriptions
YE:	annual endowment income
Z:	annual performance capacity
π:	surplus revenue

TABLE 6 (Continued)

Exogenous Variables:	
ATPR:	the ratio of profits after income tax to stockholders' equity for all manufacturing corporations
BNEA:	annual appropriations by the National Endowment for the Arts
BTPR:	the ratio of profits before income tax to stockholders' equity for all manufacturing corporations
CMPHR:	compensations per hour in the private non-farm sector
Crm:	crime rate for the area of interest
GNP:	gross national product
i:	interest rate
MQ:	maximum attainable number of performances
PC1:	an index of the price of transportation within the relevant area
PC2:	an index of the price of services within the relevant area
Pop:	the population of the region of interest
PS:	price of substitutes such as other types of the performing arts and the mass media
SE:	stockholders' equity for all manufacturing corporations
SPI:	Standard & Poor's common stock price index
T:	number of organizations in this art form
t:	average tax rate for the contributors
Tr:	trend variable
Um:	unemployment rate of the population in the area of interest
YD:	per capita disposable income of the population in the area
YDT:	total disposable income of the population in the area
α:	historically-derived ratio of subscription to capacity
β:	the discount rate for subscription price

average utilization rate and the annual performance capacity. Alternatively, equation (1.2) shows attendance as a function of the same variables, in which case average utilization is the quotient of attendance and annual performance capacity as in equation (2.2). Equation (3) defines annual performance capacity as the product of total capacity and the annual number of performances per theater. The cost function specified in equation (4) is dependent on the output level, and the pressures for wage increases are accounted

for by use of the compensations per hour in the private non-farm sectors. Equation (5) defines the price level as a function of the lagged net cost per person attending, the ratio of the deficit-surplus fund to the annual operating budget, and last period's price level. In equation (6), net cost is defined as the cost of producing the performances net of endowment income and grants, but including advertising expenditures. Endowment income is the interest earned on the endowment. The interest rate shown in equation (7) is dependent on the nature of the endowment and the risk premium it commands. Equation (8) states that the deficit-surplus fund is incremented by surplus revenue, where surplus revenue is defined in equation (9) as the difference between revenue and net costs. Equations (10) and (11) specify that endowment is incremented from period to period by the surpluses in the deficit-surplus fund, if any. In equation (12), revenue is defined as the product of the average price of admission and attendance less the discount for subscription buyers.

Total grants received by the organization are separated according to their source. Public grants are presented as Federal grants plus regional agencies' grants. Private grants and contributions include those from individuals, corporations, and foundations. As shown in equations (14) and (15), public grants depend on the level of output, attendance, the previous period's grants, lagged and current budget for the NEA, and the level of the gross national product. Private contributions, as specified in equation (16), depend on the level of activity for the organization, promotional activities, the marginal tax rate faced by the contributors, stockholders' equity in manufacturing corporations, level of profits before and after income tax, and a common stock price index. Grants from foundations, as shown in equation (17), depend on the success of the organization seeking them and its plans for expansion.

Since the Opera operates under a zero-profit constraint, equation (18) is used to determine the appropriate output level. That is, the costs of operation and advertising must be covered by revenue from attendance, and last period's grants, endowment income and surplus revenue; and there is only one level of output at which this equation will hold.

Equation (19) defines the total seating capacity as equal to last period's desired seating capacity plus the change in capacity whereas the change in capacity is defined as the difference between last period's desired and actual capacities (see equation (20)). The total capacity expansion factor is shown in equation (21) as a function of the number of performances per theater, the average utilization rate, the proportion of maximum attainable output realized, and changes in attendance.

Advertising expenditures are composed of two components: advertising for subscription sales and advertising for contributions. In equation (23), advertising expenditures for the promotion of subscription sales is specified as a function of the desired expansion of subscription sales, the number of performances, and last period's deficit-surplus fund level. The desired expansion of subscription sales in equation (27) is the difference between the desired level of subscriptions and last period's actual level of subscriptions. Advertising expenditures for soliciting private contributions, equation (24), are related to last period's change in annual total grants net of private contributions, the deficit-surplus fund, the total change in output, and last year's level of private contributions. Total advertising expenditures are simply the sum of expenditures for subscription sales and expenditure for the solicitation of private contributions.

Equation (26) defines the change in annual total non-private grants as the difference between current and last period's annual total grants, net of private contributions. Equation (28)

defines the desired level of subscriptions as an historically-derived ratio of last period's total seating capacity. The actual level of subscriptions depends on current advertising expenditures for subscription sales, average price of admission, and last period's subscription level and a trend variable (see equation (29)).

4. Symphonies

The objective function for Symphonies is also constrained attendance maximization, with the constraining being zero profits. The distinguishing characteristic of Symphonies, as opposed to Non-Profit Theater and Opera, is the Ford Foundation Symphony Program. This program was set up by the Ford Foundation in 1966 for a ten-year period. During the first five years symphonies raised matching funds for the endowment trust, composed of Ford Motor Company stock, set up by the Foundation. The symphonies also received assistance from the Foundation in their fund-raising and special projects. The second five years were a period when the symphonies were restricted in their control of the endowment trust and the matching funds, as well as their level of operations. At the end of the ten years, 1976, the symphonies had complete access to the trust and the matching funds. The model incorporates the effect of the Ford Program on the finances of symphonies by accounting for the interest income derived from the matching funds, and the dividend income received from the Ford Motor Company stock. In addition, a dummy variable is used in the equation for foundations' grants to account for the matching funds, expendable grants, and the overall Ford Foundation Program. The conceptual model which was developed is presented in Table 7, while Table 8 provides a list of the variables used in the model.

As with previous models, demand can be measured in two ways. Equation (1.1) specifies average utilization as a function of price, annual performance capacity, the desired expansion of subscription sales, disposable income of the population in the area, unemployment and crime rates, as well as promotional activities by

BEST COPY AVAILABLE

TABLE 7: SYMPHONIES - CONCEPTUAL MODEL

(1.1) $AU = f(P,Z,SAdv,W;PC1,PC2,PS,YD,YDT,Um,Crm)$

or

(1.2) $A = f(P,SAdv,W,Z;PC1,PC2,PS,YD,YDT,Um,Crm)$

(2.1) $A = AU \cdot Z$

or

(2.2) $AU = A/Z$

(3) $Z = Cty \cdot Q/T$

(4) $C = f(Q;CMPHR)$

(5) $P = f(NC,NCA;NCA_{-1},DSFR,P_{-1})$ (subscripts indicate lags)

(6) $NC = C-YE-GO-YFD-YMFD+TAdv$

(7) $YE = i \cdot E$

(8) $YMFD = i \cdot MFD$

(9) $DSF = DSF_{-1} + \pi$

(10) $\pi = R-NC$

(11) $E = E_{-1} + \Delta E$

(12) If DSF>0, then ΔE = DSF and DSF = 0
Otherwise $\Delta E = 0$

(13) $R = P-A-\beta \cdot Sbr \cdot Q \cdot P/T$

(14) $G = GF+GR+CPr+GFn$

(15) $GF = f(Q,A;GF_{-1},BNEA,DMM,PDGNP)$

(16) $GR = f(Q,A;GR_{-1},BNEA_{-1},DMM,GNP)$

(17) $CPr = f(A,\frac{A}{Pop},CAdv;CAdv_{-1},t,SE,BTPR,ATPR,SPI,DMM)$

(18) $GFn = f(A,X,DSF/(R+G),DSF,Q,\Delta Cty;DMM)$

(19) $GO = G-\Delta MFD$

(20) $O = R(Q)-C(Q) + \pi_{-1}+GO_{-1}+YFD_{-1}+YMFD-TAdv+YE_{-1}$

(21) $Cty = Cty_{-1} + \Delta Cty$

(22) $\Delta Cty = XCty_{-1} - Cty_{-1}$

(23) $X = f(AU,Q/MQ,PDA,Q,Q/T)$

(24) $XCty = Cty \cdot X$

(25) $MFD = MFD_{-1}+\Delta MFD$

(26) $SAdv = f(W,Q;DSF_{-1})$

(27) $CAdv = f(DSF,DSFR,\Delta Q;\Delta OG_{-1},CPr_{-1})$

(28) $TAdv = SAdv + CAdv$

(29) $\Delta OG = (G-CPr) - (G-CPr)_{-1}$

(30) $W = XSbr - Sbr_{-1}$

(31) $XSbr = \alpha \cdot Cty_{-1}$

(32) $Sbr = f(SAdv,P;Sbr_{-1},Tr)$

(33) $NCA = NC/A$

(34) $DSFR = DSF/(R+GO)$

(35) $PDA = (\Delta A/A) \cdot 100$

(36) $\Delta A = A-A_{-1}$

(37) $\Delta Q = Q-Q_{-1}$

76

BEST COPY AVAILABLE

TABLE 8: SYMPHONIES - ENDOGENOUS AND EXOGENOUS VARIABLES

Endogenous Variables

A:	annual attendance
ΔA:	change in annual attendance
AU:	average utilization rate per performance
C:	annual total cost
CAdv:	advertising expenditures for the soliciting of private contributions
CPr:	annual private grants
Cty:	total seating capacity
ΔCty:	change in seating capacity
DSF:	a deficit-surplus fund for operations
DSFR:	the ratio of the surplus-deficit fund to the operating budget
E:	endowment
ΔE:	change in endowment
G:	annual total grants
GF:	annual federal grants
GFn:	annual grants by foundations
GO:	annual total grants net of the annual increment to the capital matching Ford funds held by symphonies
GR:	annual grants from regional agencies
MFD:	capital matching Ford funds held by symphonies
NC:	annual net cost
NCA:	net cost per attendee
ΔOG:	change in annual total grants net of annual private contributions
P:	average price of admission
PDA:	percentage change in annual attendance
Q:	number of performances
ΔQ:	change in the number of performances
R:	annual revenue
SAdv:	advertising expenditures for the promotion of subscriptions' sales
Sbr:	actual level of subscriptions
TAdv:	total advertising expenditures
W:	the desired expansion of subscription sales
X:	total capacity expansion factor
XCty:	desired seating capacity
XSbr:	desired level of subscriptions
YE:	annual endowment income
YMFD:	interest from capital matching Ford funds held by symphonies
Z:	annual performance capacity
π:	surplus revenue

77

TABLE 8: (Continued)

Exogenous Variables

ATPR:	the ratio of profits after income tax to stockholders' equity for all manufacturing corporations
BNEA:	annual appropriations by the National Endowment for the Arts
BTPR:	the ratio of profits before income tax to stockholders' equity for all manufacturing corporations
CMPHR:	compensation per hour in the private non-farm sector
Crm:	crime rate for the area of interest
DMM:	a dummy variable for the years the Ford Foundation Symphony Program was in its matching funds accumulation stage (the years the symphonies had to raise matching funds)
GNP:	gross national product
i:	interest rates
ΔMFD:	annual increment to the capital matching Ford funds held by symphonies
MQ:	maximum attainable number of performances
PC1:	an index of the price of transportation within the relevant area
PC2:	an index of the price of services within the relevant area
PDGNP	percentage change in gross national product
Pop:	the population of the region of interest
PS:	price of substitutes such as other types of the performing arts and the mass media
SE:	stockholders' equity for all manufacturing corporations
SPI:	Standard & Poor's common stock price index
T:	number of symphonies
t:	average tax rate for the cont[illegible]tors
Tr:	trend variable
Um:	unemployment rate of the population in the area of interest
YD:	per capita disposable income of the population in the area
YDT:	total disposable income of the population in the area
YFD:	dividends from Ford held trust funds
α:	historically-derived ratio of subscription to capacity
β:	the discount rate for subscription price

the symphonies. Attendance in this case is defined in equation (2.1) as the product of average utilization rate and annual performance capacity. Alternatively, equation (1.2) shows attendance as a function of the same variables in which case average utilization is the quotient of attendance and annual performance capacity, as shown in equation (2.2). Annual performance capacity shown in equation (3), is the product of total capacity and the annual number of performances per symphony. The cost function is specified in equation (4) as being dependent on the output level and the pressures for wage increases, as measured by compensation per hour in the private non-farm sector.

The price level in equation (5) is a function of the lagged net cost per person attending, the ratio of the deficit-surplus fund to the annual operating budget, grants net of the matching funds raised in that year, and last period's price level. Equation (6) defines net cost as the cost of producing the performances net of endowment income, grants net of matching funds for the year, dividend income from the Ford Foundation trust fund, and interest income from the accumulated matching funds held by the symphonies, plus advertising expenditures. Endowment income is defined in equation (7) as the product of the interest rate and the endowment principal.

Equation (8) states that the interest income from the accumulated matching funds held by the symphonies depends on the interest rate on such funds and the magnitude of the funds. Equation (9) shows that the deficit-surplus fund is incremented during each time period by surplus revenue, where surplus revenue is defined in equation (10) as the difference between revenue and net costs. Likewise, the endowment is incremented from period to period by the surpluses (not the deficits) in the deficit-surplus fund, as shown in equations (11) and (12). Revenue, as defined in equation (12), is the product of the average price of admission and attendance, less the discount for subscription buyers.

Grants are divided into two types, public and private. In equation (14), public grants are represented as both Federal grants and regional agencies' grants. Private grants and contributions include those from individuals, corporations, and foundations. Equations (15) and (16) show public grants as dependent on output, attendance, the previous period's grants, lagged and current budgets for the NEA, the gross national product and changes in it, and a dummy variable for the Ford Foundation Symphony Program. Private contributions, as shown in equation (17), depend on the level of activity of the organization, promotional activities, the average tax rate faced by the contributors, and the last period's advertising expenditures, etc. There is also a dummy variable for the Ford Foundation Symphony Program. Grants from foundations are specified in equation (18) as dependent on the financial position of the symphony seeking them and its zeal in such a pursuit. Measures of these items include attendance, plans for expansion and the ratio of the deficit-surplus fund to the annual operating budget. Again, a dummy variable is included for the Ford Program. Equation (19) defines grants for operations as total grants net of the portion allocated to the capital matching Ford funds in that year.

As shown in equation (20), the symphonies operate under a zero-profit constraint. This constraint is based on revenues from attendance just sufficient to cover the differences between operating and advertising cost and the sum of last period's grants net of the matching funds for the year, surplus revenue, lagged dividend income, current interest from capital matching Ford Foundation funds, and lagged endowment income. In the process of establishing operating costs and revenues that satisfy the equality of equation (20), the system also determines the desired output level. Equation (22) defines the change in seating capacity as the difference between last period's desired and actual capacities. The total capacity expansion factor is defined as the ratio

of desired capacity to actual capacity (see equation (24)), and is a function of the number of performances per symphony, the average utilization rate, the proportion of maximum attainable output realized, the change in attendance, output, etc. as described in equation (23). Equation (25) states that the capital matching Ford funds are incremented annually by an amount set by the Ford Foundation Orchestra Program.

Advertising expenditures for the promotion of subscription sales are dependent on the desired expansion of subscription sales, the number of performances, and last period's deficit-surplus fund level (see equation (26)). Equation (27) shows advertising expenditures for soliciting private contributions as a function of last period's change in annual total grants net of private contributions, the deficit-surplus fund, the change in output, and last year's private contributions. Total advertising expenditures in equation (28), are simply the aggregation of expenditures for subscription sales and for the solicitation of private contributions. Equation (29) defines the change in annual total non-private grants as the difference between current and last period's annual total grants net of private contributions. The desired expansion of subscription sales (equation (30)) is the difference between the desired level of subscriptions and last period's actual level of subscriptions, where the desired level of subscriptions is an historically-derived proportion of last period's total seating capacity as shown in equation (31). The actual level of subscriptions in equation (32) depends on current advertising expenditures for subscription sales, average price of admission, and last period's subscription level.

5. Ballet and Dance

The models for Dance and Ballet are essentially the same as the model specified earlier for the Non-Profit Theater. The similarities among the three groups of organizations are:

- the endowment is insignificant or totally absent,
- the unit of output is the performance and attendance per performance can vary up to the capacity of the physical setting, and
- the desired production level is that where profits are zero, but this level is not necessarily realized because of information lags.

6. Museums

The objective function for Museums is also constrained attendance maximization, with the constraining being zero profits. That is, attendance is increased up to the point where total receipts are equal to total expenditures.

The presentation for either the Non-Profit Theater model or the Opera model is adequate as a discussion of the workings of the Museum model, with the following exceptions. The sources of earned income for Museums are membership dues, admission charges, charges for special programs, sale of publications and reproductions, and auxiliary services, such as parking areas and restaurants. This led to the development of several behavioral relationships to account for the various specialized components of earned income. The same procedure was also followed for expenditures since there are several special components in the Museum industry. The capital accumulation process for Museums includes the expansion of the stock of exhibit items. This expansion can be defined as an increase in the stock of exhibit items, where the increase is partially dependent on the proportion of the stock actually put on exhibit. In addition, the ability to expand this stock is a function of the financial status of the organization. The conceptual model which was developed for Museums is presented in Table 9 and Table 10 provides a list of the variables used.

Equation (1) defines the total revenue from all sources as the sum of annual total membership dues, total admission

TABLE 9: MUSEUMS - CONCEPTUAL MODEL

(1) $R = MR+AR+OR$

(2) $MR = M \cdot PM$

(3) $AR = GA \cdot PA$

(4) $OR = f(A, CPrg1, Pbl, M, \Delta G)$

(5) $M = f(PM, \Delta S, TR, DSF; M_{-1}, Pbl_{-1}, DSF_{-1})$ (subscripts indicate lags)

(6) $PM = f(\pi_{-1}, \pi, PM_{-1})$

(7) $GA = f(Q, PA; \Delta S_{-1}, S_{-1}, PC1, PC2, PC3, PS, YD, YDT, Um, Crm, CPI)$

(8) $PA = f(DSFR, (NCA_{-1}), PA_{-1})$

(9) $\Delta G = G - G_{-1}$

(10) $A = MA+GA$

(11) $G = GF+GR+CPr+GFn$

(12) $GF = f(A, Q, CPrg, DSF, \pi; \Delta PDGNP, YD, GF_{-1})$

(13) $GR = f(A, Q, CPrg; \Delta PDGNP, GR_{-1})$

(14) $CPr = f(Q, \Delta S, CPrg, Pbl, CAdv; CAdv_{-1}, t, SE, BTPR, ATPR, SPI)$

(15) $GFn = f(A, Q, S, CPrg, DSF, \Delta S; \Delta G_{-1})$

(16) $YE = i \cdot E$

(17) $E = E_{-1}+\Delta E$

(18) If DSF>0, then ΔE = DSF & DSF = 0
Otherwise $\Delta E = 0$

(19) $C = CP+CSA+CPrg+CPbl+CAx+CRs$

(20) $CP = f(Q; H_1)$

(21) $CSA = f(\Delta S; H_1)$

(22) $CPrg = CPrg1+CPrg2$

(23) $CPbl = f(Pbl, M; RgJ, H_1)$

(24) $CAx = f(A)$

(25) $CRs = f(\Delta S; C_{-1}, H_1)$

(26) $CAdv = f(G, DSF; \Delta G_{-1}, DSF_{-1}, \Delta M_{-1})$

(27) $\Delta M = M - M_{-1}$

BEST COPY AVAILABLE

TABLE 9: (Continued)

$$(28)\quad \pi = R+G+YE-C-CAdv$$

$$(29)\quad DSF = DSF_{-1}+\pi$$

$$(30)\quad 0 = R(Q)-C(Q)+G_{-1}+\pi_{-1}-CAdv+YE_{-1}$$

$$(31)\quad S = S_{-1}+\Delta S$$

$$(32)\quad \Delta S = f(YE,CPr;US_{-1},DSFR_{-1})$$

$$(33)\quad US = SUD/S$$

$$(34)\quad SUD = f(Q,S)$$

$$(35)\quad CPrg1 = f(M;\Delta G_{-1},\Delta A_{-1},\Delta S_{-1},DSF_{-1},CPrg1_{-1})$$

$$(36)\quad CPrg2 = f(DSF,G;\Delta S_{-1})$$

$$(37)\quad NC = C+CAdv-G-YE-MR$$

$$(38)\quad \Delta A = A-A_{-1}$$

$$(39)\quad Pbl = f(M,A,PM;DSF_{-1})$$

$$(40)\quad DSFR = DSF/(R+G)$$

$$(41)\quad NCA = NC/A$$

$$(42)\quad MA = K-M$$

$$(43)\quad TR = R+G+YE$$

charges, and revenue from programs, publications, and auxiliary activities; where annual total membership dues are the product of the number of members and their individual dues (equation (2)), total admission revenues (equation (3)) are the product of total paid attendance and the price of attendance, and the remaining revenues (equation (4)) are a function of total attendance expenditures on paid programs, the number of publication copies, the membership count, and the change in grants. Equation (5) specifies the number of members as a function of the price of membership, total revenue (to measure the scale of operations), the size of the deficit-surplus fund, changes in the stock of exhibit items, changes in grants, last period's membership count,

BEST COPY AVAILABLE

TABLE 10: MUSEUMS - ENDOGENOUS AND EXOGENOUS VARIABLES

Endogenous Variables

A:	annual total attendance
ΔA:	change in annual total attendance
AR:	total admission charges
C:	annual total cost
CAdv:	annual advertising expenditures
CAx:	annual cost for all auxiliary services
CP:	annual operating, production, cost
CPbl:	annual publications' cost
CPr:	annual private contributions
CPrg:	annual educational and other group programs' cost
CPrg1:	expenditures on paid educational programs
CPrg2:	expenditures on free educational programs
CRs:	annual cost of research activities
CSA:	annual expansion cost
DSF:	deficit-surplus fund
DSFR:	the ratio of the surplus-deficit fund to the operating budget
E:	current endowment
ΔE:	change in the endowment for the current period
G:	annual total grants
ΔG:	change in total grants
GA:	annual general attendance
GF:	annual federal grants and support
GFn:	annual foundation grants
GR:	annual state and local grants and support
M:	membership count
MA:	membership attendance
ΔM:	change in membership
MR:	annual total membership dues
NC:	total net cost
NCA:	net cost per attendee
OR:	sum of program, publications and services revenue
PA:	price of admission
Pbl:	annual total number of publication copies, this is the aggregation of the number of copies of each publication
PM:	membership price, dues
Q:	output, in terms of (8-hour) days of operations weighted by administrative expenditures
R:	total revenue from all sources, earned income
S:	current stock of exhibit items and facilities for exhibits
ΔS:	change in the stock of exhibit items and facilities
SUD:	stock utilized in current output
TR:	annual total earned and unearned revenue
US:	ratio of utilized to total stock of exhibit items and facilities
YE:	annual endowment income
π:	surplus revenue

TABLE 10: (Continued)

Exogenous Variables:

ATPR:	the ratio of profits after income tax to stock-holders' equity for all manufacturing corporations
BTPR:	the ratio of profits before income tax to stock-holders' equity for all manufacturing corporations
CPI:	consumer price index
PDGNP:	percentage change in gross national product
H_1:	a set of homogenizing indicators which accounts for the heterogeneity of the output or quantity measures
i:	the interest rate relevant to the endowment investment
PC1:	an index of the price of transportation within the relevant state
PC2:	an index of the price of services within the relevant state
PC3:	an indicator of the length of time of waiting to enter the museum
PS:	an index of the price of reading and recreation within the relevant area
RaJ:	copy count for regular journals
SE:	stockholders' equity for all manufacturing corporations
SPI:	Standard & Poor's common stock price index
t:	average tax rate for contributors in each state
Um:	unemployment rate of the population in the relevant state
YD:	per capita disposable personal income of the population in the area
YDT:	total disposable personal income of the population in the state
K:	average number of attendance per year per member

the number of publications, and the size of the deficit-surplus fund. Membership dues are shown in equation (6) to be a function of last period's surplus revenue, and last period's dues.

Annual general attendance in equation (7) depends on price and income variables as well as the output of the Museums, their stock of exhibit items and facilities. The crime rate for the area is also included, since it acts as a deterrent to attendance. The price of admission is specified in equation (8) to be a function of

the ratio of the deficit-surplus fund to total operating budget, last period's net cost per attendee and last period's price of admission. Annual total attendance is defined in equation (10) as the sum of membership attendance and annual general attendance. Equation (11) shows annual total grants as the sum of Federal and regional grants, private contributions, and foundation grants. Federal grants are dependent on annual total attendance, the annual cost of the programs offered, the deficit-surplus fund, and surplus revenue. In addition, the percentage change in gross national product is included as an income constraint for the government. Last period's Federal grants were included to dampen the changes in this period's grants since drastic fluctuations are not likely in these grants, especially in the aggregate. Regional grants, as shown in equation (13), are dependent on the same variables as Federal grants, with the exception of substituting last period's regional grants for Federal grants, and deleting the deficit-surplus fund and surplus revenue variables.

The private contributions of equation (14) depend on the level of output, new acquisitions, expenditures on all programs, the number of publications, and the level of promotional activities. These measures capture the characteristics that distinguish museums from other would-be recipients of private contributions. In addition, the level of private contributions is determined by the average tax rate faced by the contributors, and wealth measures for the likely contributors. Equation (15) shows contributions by foundations as dependent on attendance, changes in the stock of exhibit items and facilities, expenditures on all educational programs, the deficit-surplus fund, and last period's changes in grants. The changes in grants is included because museums often turn to foundations if their other grants are reduced. Annual endowment income is determined as the interest earned on the endowment (equation 16)), whereas equations (17) and (18) specify that the endowment is incremented from period to period by the surplus (not the deficit) in the deficit-surplus fund when such surpluses exist.

In equation (19), annual total museum cost is represented as the sum of production, expansion, programs, publications, auxiliary services, and research costs. The costs of production are described in equation (20) as a function of the number of days of operation and several homogenizing variables to account for different types of museums.

Total annual expenditures for programs are equal to the sum of expenditures on both paid and free programs, as shown in equation (22). Equation (23) specifies the annual cost of publications as a function of a quantity variable and the mix of regular journals and membership publications. In addition, homogenizing indicators are included. The cost of auxiliary services in equation (24), is a function of annual total attendance. The cost of research is a function of the change in the stock of exhibit items and facilities, last period's total costs, and homogenizing indicators (equation (25)).

Advertising expenditures in equation (26) are dependent on the level of grants and the deficit-surplus fund, and on the lagged values for the changes in grants, the change in the deficit-surplus fund, and the change in membership (where the change in membership is calculated as the current membership count minus last period's count). Equation (28) defines surplus revenue as the sum of total revenue, total grants, endowment income minus total costs and advertising expenditures. The deficit-surplus fund is incremented annually by surplus revenue, as shown in equation (29).

The individual non-profit museum is assumed to pursue an objective of zero profit. It assumes that the conditions of the last period indicate the level of its current grants, surplus revenue, and endowment income. Since variations in these variables occur over time, the outcome could be an actual deviation from the planned zero profit objective. Equation (30) determines museums' desired output level on the basis of the above objective.

The stock of exhibit items and facilities is periodically incremented, as shown in equations (31) and (32). The amount of the increment is determined by the level of endowment income, private contributions, the lagged utilization rate of exhibit items and facilities, and the ratio of the deficit-surplus fund to the total operating budget. The utilization rate of exhibit items and facilities in equation (33) is the ratio of the stock actually used to total stock available, where the stock of exhibit items utilized in any period (see equation (34)) is a function of the output level and the total stock available. The expenditures programs that are offered by museums for a fee are dependent on the membership count, the lagged changes in total grants, total attendance, and stock of exhibit items and facilities. In addition, the lagged deficit-surplus fund and expenditures on paid programs are included among the potential explanatory variables in equation (35). In equation (36), the expenditures on the free programs that are offered by museums are dependent on the deficit-surplus fund, total grants and the lagged change in the stock of exhibits and facilities.

Total net costs are defined in equation (37) as the difference between the sum of total costs and advertising expenditures, and the sum of total grants, endowment income, and total membership dues. The aggregate number of copies across all publications is a function of the number of members, total attendance, membership dues, and last period's surplus-deficit fund, as shown in equation (39).

This completes the presentation and description of the conceptual behavioral models for each type of arts and cultural institution. The next section describes the technique to be used to generate short-term trend projections for each type of arts and cultural institution.

VI. ECONOMETRIC MODEL ESTIMATION

A. Introduction

While the major thrust and impact of the study has been in the areas of conceptual model building (Section V) and in the compilation and analysis of a data base (Section IV), an attempt was also made to blend the two together in an effort to estimate the parameters of the several models. Due to the inadequacy of the data base, and the time and resource limitations of the present contract, it was not possible to provide a definitive econometric analysis. Further, the analysis was not sufficient to generate the complete set of unbiased parameter estimates necessary to employ the models for forecasting or simulation. Sufficient time and resources were available, however, to accomplish much of the initial econometric research in order to provide a firm basis for subsequent data collection and further analysis.

This is not to say that significant policy implications were not obtained from the analytical effort. To the contrary, many significant questions have been answered. First, however, the method of estimation requires explanation. The preferred mode of estimation in simultaneous equation models is two- or three-stage least squares due to the consistency of their estimates. However, Ordinary Least Squares (OLS) was used in the present estimation for the following reasons:

- The data sets that were available included observations on enough variables for system estimation for five of the seven art forms under study. But these data sets consisted of only nine observations which ruled out the use of simultaneous estimators on technical grounds, since the number of instrumental variables exceeds the number of observations. Furthermore, the large sample consistency property of simultaneous estimators is of little comfort in a sample of only nine observations.
- The use of simultaneous estimators in a preliminary study is not recommended, since these techniques are more sensitive to specification errors than Ordinary Least Squares. Thus, if an equation is misspecified a simultaneous system estimator carries the biasedness resulting from the misspeification throughout the system, while Ordinary Least Squares limits the biasedness to the misspecified equation.

- Finally, Rao and Miller suggest that "whenever the computed R^2 is close to unity, even though the estimated equation is a part of a simultaneous - equations model, direct least squares is doing a 'good' job." (Rao, P. and Miller, R.L., Applied Econometrics, p. 195).

B. Model Estimates

The models were divided into three groups for estimation purposes on the bases of the objective functions of the models and the data bases available to be used in the estimation. These three groups are:

- For-Profit Theater, Broadway,
- Non-Profit Art Organizations, excluding Museums, and
- Museums

The discussion of the model estimation is also based on the above grouping. It should be kept in mind that this grouping does not imply that the same results should be expected for all art forms within a given group. The grouping merely reflects similarities of goals and data availability.

Due to the limited degrees of freedom, a problem almost throughout the study, the presence of autocorrelation could neither be established nor eliminated in the majority of the equation estimations. In the first instance, the inconclusive range of the typical indicator of autocorrelation, the Durbin-Watson statistic, increases the smaller the sample size. In the second instance, even if the existence of autocorrelation is presumed (and it should be when dealing with time series data), the traditional method of dealing with it, the Cochrane-Orcutt technique, is also precluded because of degrees of freedom problems. (It should be added in this regard that the other uses of generalized least squares to correct serial correlation suffer from the same problem because the number of observations is further reduced as the coefficient of autocorrelation is computed.) On balance then, the estimation effort presented below, while constrained by data limitations, contains as much rigor as can be expected, and is sufficiently thorough to

test a number of hypotheses and lay the groundwork for more extensive model estimation and simulation efforts as more data become available.

1. For-Profit Theater, Broadway

The For-Profit Theater model contains five behavioral relationships which determine demand, supply, advertising, pricing, and capital accumulation behavior. Unfortunately, the lack of adequate cost and seating capacity data limited the model estimation to the demand function. Further, the data deficiencies precluded the computation of utilization rates so that the demand estimation was limited to that using attendance as the dependent variable. However, four attendance equations were estimated:

- estimated average February weekly attendance for all shows,
- average February weekly audience size per performance for all shows,
- estimated average February weekly attendance for plays, and
- estimated average February weekly attendance for musicals.

While the initial estimation was undertaken for both linear and log-linear models, the differences in the results were not sufficient to justify continued duplication of effort, so the log-linear relationship estimation was terminated. Ordinary Least Squares was used for this model even though the span of the available data would have been adequate for simultaneous equation estimation had adequate cost and capacity data been available. The data were sufficient, however, to be tested for the presence of autocorrelation, and the Cochrane-Orcutt method was used for correction whenever autocorrelation was indicated. Regressions were run for alternative specifications, the "best" estimate for each of the four attendance equations is presented in Table 11 with the variables used defined as in Table 12. Additional estimates (i.e., those not selected the "best") are presented in Tables B.1 through B.5 in Appendix B. The basis for selecting the "best" estimates were:

- whether the results were in line with expectations as to parameter sizes and signs based on economic theory and the advice of the project consultants, and
- whether the results were statistically significant. (This decision was complicated by the large number of explanatory variables from which to choose, the fact that many were highly collinear, and the small number of observations for some of the variables.)

TABLE 11: SELECTED ESTIMATES FOR THE DEMAND FUNCTION FOR THE FOR-PROFIT THEATER MODEL[1/]

(1) A1 = 111.1566 - 10.8167 P + .0734 Y - .2281 PS (2.1846) (-1.6292) (1.6469) (-.2989)	$\bar{R}^2$ = .4856 DW = 2.1846
(2) A2 = 15.8713 - 1.0296 P + .0028 Y + .0381 PS (3.6366) (-1.6615) (.8066) (.6348)	$\bar{R}^2$ = .3568 DW = 1.6989
(3) A3 = 206.4631 - 5.0558 P + .1575 Y - 4.9901 PS + 6.3989 Um (9.6343) (-.9545) (3.6133) (-4.1448) (2.2619)	$\bar{R}^2$ = .6234 DW = 2.1941
(4) A4 = -13.8041 - .5542 P + .0244 Y + .6621 PS (-.4161)(-.1393) (.6880) (1.1051)	$\bar{R}^2$ = .6272 DW = 2.0532

[1/] The values enclosed in parentheses are the t statistics for the estimated coefficient; $\bar{R}^2$ is the adjusted coefficient of multiple determination; and DW is the Durbin-Watson statistic. The crucial t-values for equations 1, 2, and 4 at the 95-percent level are 2.056, and the critical t-value for equation 3 at the 95-percent level is 2.179.

The equations of Table 11 suggest a demand that is price inelastic (evaluated at the mean values of the variables), especially for musicals. This should be expected since the admission price is only a small part of the total cost or effective price of attending the theater. Baumol and Bowen, as well as Moore, computed the price of admission to be equal to approximately half of the effective price, (Baumol, W. and Bowen, W., Performing Arts - The Economic Dilemma, p. 500) and (Moore, T.G., The Economics of the American Theater, pp. 82-84). It should

TABLE 12: THE VARIABLES USED IN THE DEMAND FUNCTIONS FOR THE FOR-PROFIT THEATER MODEL

Variable	Description
A1	estimated average February weekly attendance for all shows
A2	average February weekly audience size per performance for all shows
A3	estimated average February weekly attendance for plays
A4	estimated average February weekly attendance for musicals
P	the price of admission (total revenue for the given period/total attendance for the period)
Y	per capita disposable personal income in 1958 dollars
PS	the consumer price index for reading and recreation, 1967 = 100
Um:	unemployment rate for whites, a proxy for the rate of unemployment for the typical theatre audience.

be noted that the price coefficient is always of the expected negative sign but is never statistically significant at the 95 percent confidence level.

The second variable in all the demand functions of Table 11 is income. The estimated relationships are all of the expected positive sign and further indicate that demand is income-inelastic (evaluated at the means of the variables) with the exception of the demand for plays which is highly income-elastic. These results should be interpreted with caution, however, since the income coefficients are not statistically significant in most cases. Nevertheless, the estimated equations suggest structural differences between the demands for plays and musicals. This could be explained if differences among the audiences were found for each. (Structural differences are also suspected with regard to the costs of production, but this, of course, is not testable with demand function estimates.)

The third variable included in the specifications of Table 11 is the consumer price index for reading and recreation, which is included as a measure of the price of substitutes.

The coefficients for this variable are generally not significant, and the demand elasticities (evaluated at the means of the variables) range from quite inelastic to highly elastic. The signs of the coefficients are variable, being negative for plays and positive for musicals. This, again, might suggest the existence of structural differences between the demand for plays and the demand for musicals, but interpreting this consumer price index as the price of substitutes in one case (musicals) and the price of complements in another case (plays) is difficult to accept. The most plausible explanation for this behavior is the high degree of multicollinearity found between this variable and per capita income. Certainly, this is an area for further data acquisition and estimation activity.

The fourth variable included in Table 11 is the unemployment rate. This variable was specified to account for the availability of leisure time and to "identify" the demand function. Only in the case of plays is it included in the "final" or "best" specification. However, the coefficient is of the expected sign (positive) and is highly significant. One interpretation of this result, and the one suggested ex ante by the project consultants, is that unemployment generates leisure time, along with a desire to use that leisure time to counterbalance the undesirable aspects of being unemployed through pleasure generating, by vicarious living experiences (e.g., plays). Another, more "economic" explanation, and one that accords more with the use of an overall unemployment rate rather than one specific to the typical audience mix, is that high unemployment is an indication of lower average incomes and a desire to reduce the consumption of luxury goods such as travel. Given that the output of the theater is consumed on location, it is likely that reduced travel will lead to increased attendance at local theaters.

Many other variables were tried in the specifications as shown in Appendix B. For example, a trend variable was included to account for unexplained trends in attendance. However, this variable was highly correlated with both income and the price index for reading and recreation, so that an unstable and statistically insignificant

relationship between the demand and the trend variable was consistently observed. By the same token, a consumer price index for all services less rent was included to try to account for the price of the complements to theater attendance. This variable was also highly correlated with the income measure and the price index for reading and recreation, with the same consistently unstable and insignificant results.

2. Non-Profit Art Organizations Excluding Museums

The model estimation undertaken for the second group of organizations covered the following art forms:

- Non-Profit Theater,
- Opera,
- Symphony,
- Ballet,
- Modern Dance,
- All the above art forms combined.

The data sets used in the estimation were obtained from the Ford Foundation. In addition, a second data set for symphonies was obtained from the Center for Policy Research. This data set is based on the American Symphony Orchestra League (ASOL) records. The availability of this second data set made it possible to double check some of the estimates for the Symphony model Selected equation estimates and their corresponding variable definitions are presented in Tables 13 through 22. Additional estimates are presented in Tables B.6 through B.61 in Appendix B. Each of the estimated models will be discussed separately, with the estimates for All Art Forms Combined being presented initially.

a. All Art Forms Combined

The data set used in the combined estimation spans nine years and includes 142 individual art organizations of the several art forms: Non-Profit Theater, Opera, Symphony, Ballet, and Modern Dance. Detailed equation estimates for the combined model are to be found in Tables B.7 through B.17 in Appendix B to this report. For

immediate discussion, Table 13 presents the estimates for the eleven behavioral equations of the combined model, and Table 14 provides the list of required variables. The combined model was chosen for discussion first because it embodies most of the elements of the models for the other art forms and the models specific to each of those art forms can then be described as variations from the combined model presentation. Each equation of the combined model is discussed in detail, below.

(1) Demand

The conceptual combined model specifies either a demand function which is based on the utilization rate for the facilities or one which is based on total attendance. A cursory comparison of the estimation undertaken for both the utilization rate, equation (1.1), and total attendance, equation (1.2) would suggest that total attendance is a better measure of demand than the utilization rate. However, it is more likely that the performance of the utilization rate is due to problems in the measurement of the total seating capacity which is used in computing this rate. Many art organizations present programs in various theaters or concert halls with varying and sometimes unknown seating capacities. It is likely, therefore, that the reported capacities contain a significant measurement error. In addition, little variation in the rate measure was observed due to the positive correlation between attendance and capacity measure ($r=.96$). Thus, the variations in attendance are associated with capacity variations which moderate the variation in the utilization rate measure.

In any case, for both equations, the signs of the price (P) coefficients are in line with theoretical expectation even though neither is statistically significant at the 95 percent confidence level. This would suggest that price fluctuations are of little influence on the quantity demanded for Non-Profit (Non-Museum) art organizations, at least within the range of price variation observed.

TABLE 13: SELECTED ESTIMATES FOR ALL ART FORMS COMBINED, EXCLUDING MUSEUMS, MODEL[1/]

(1.1)	AU = 52.5391 - 10.6377 P - .0077 YD + 31.4868 PS + 135.4252 PC1 + .00000183 Cty - .2145 Crm (3.5225) (-2.1856) (-.9393) (.6304) (1.8449) (.9674) (-2.7997)	$\bar{R}^2$ = .7088 t(.05) = 4.303
(1.2)	A = 288184 - 156520.8 P + 427.856 YD + 1061.334 Q (.2390) (-.5711) (.7164) (5.5422)	$\bar{R}^2$ = .9566 t(.05) = 2.571
(4)	C = - 78850096 + 12579.254 Q + 118432160 CMPHR (-2.2485) (2.9294) (6.3908)	$\bar{R}^2$ = 0.9691 t(.05) = 2.447
(5)	P = 2.2122 + 4.2419 DSFR + .00000006 NC - 0.6870 P_{-1} (2.4700) (1.0950) (3.7127) (-1.8241)	$\bar{R}^2$ = 0.8965 t(.05) = 2.571
(15)	GF = 2468180 - 151 Q + .1562 BNEA (.3031)(-.1883)(3.6376)	$\bar{R}^2$ = .8223 t(.05) = 2.447
(16)	GR = 10405546 - 665.9216 Q + .0926 $BNEA_{-1}$ - 1316.3523 GNP (2.7043) (-1.9981) (4.5542) (1.2102)	$\bar{R}^2$ = .9059 t(.05) = 2.571
(17)	CPr = - 62418880 + 221444900 t + 144982.6875 SPI - 1.2590 CAdv (-4.5705) (4.6749)	$\bar{R}^2$ = 0.9077 t(.05) = 2.571
(18)	GFn = -13959027 - 25088976 X + 67437968 DSFR + 4285.8711 Q + 2497796 DMM (-4.3383) (-9.0964) (9.6428) (9.3308) (12.1932)	$\bar{R}^2$ = .9874 t(.05) = 3.182
(23)	X = 0.9683 + 0.6934 PDA (93.0882) (3.3865)	$\bar{R}^2$ = 0.6964 t(.05) = 2.447
(27)	CAdv = 2042046.1875 + .01928 CPr_{-1} - 21.0758 ΔQ + .05712 DSF (.4634) (.2730) (-.6325) (.6301)	$\bar{R}^2$ = Neg.[2/] t(.05) = 2.571
(32)	Sbr = -5113771 + 1229797 P (-4.8341) (5.7646)	$\bar{R}^2$ = 0.8260 t(.05) = 2.365

[1/] The values enclosed in parentheses are the t statistics; the values t (.05) are the critical t-values at the 95 percent level; $\bar{R}^2$ is the adjusted coefficient of multiple determination. Equation numbers correspond with those presented in the conceptual modelling section, above.

[2/] Adjusted R^2 was negative which indicates a very low explanatory power for this relationship.

TABLE 14: VARIABLES USED IN ALL FORMS COMBINED, EXCLUDING MUSEUMS, MODEL[1/]

Variable	Description
A	Annual total ticketed attendance
AU	Percent seat capacity filled
BNEA	Annual appropriations by the National Endowment for the Arts to various programs and agencies
C	Annual total operating expenditures less the costs of fund raising
CAdv	Annual fund raising costs and fees
CMPHR	Compensation per hour in private non-farm sectors, 1972 = 1.00. Wages and salaries of employees plus employers' contributions for social insurance and private benefit plans. Also includes an estimate of wages, salaries, and supplemental payments for the self-employed
CPr	Annual total local nongovernment contributions
Crm	Violent crime rate for the U.S. per 100,000 inhabitants, offenses of murder, forcible rape, robbery, and aggravated assault
Cty	Total seats available--main season and other
DFM	A dummy variable for the years 1965/66 through 1970/71, the years the Ford Foundation Symphony Program was in its matching funds stage.
DSF	Balance of the surplus-deficit fund at the end of the year
DSFR	The ratio of the surplus-deficit fund to the operating budget
GF	Annual federal grants
GFn	Annual foundations grants

Variable	Description
GNP	Gross National Product in billions of 1972 dollars
GR	Annual total local government grants
NC	Annual total operating expenditures net of total unearned income (grants, contributions, and corpus earnings used for operations)
P	Average realized price of admission
PDA	Percentage change in annual total attendance
PS	Consumer price index for reading and recreation, 1972=1.00
PC1	Consumer price index for transportation services, 1972=1.00
Q	Annual total ticketed performances
ΔQ	Change in annual total ticketed performances
Sbr	Annual total of subscriptions purchased
SPI	Standard & Poor's common stock price indexes, (500 stocks) (1941-43=10)
t	Average tax rate, ratio of the receipts of the federal, state and local government to the National Income
X	Annual seating capacity expansion factor
YD	Per capita disposable income in 1972 dollars

[1/] Monetary value are expressed in 1972 dollars.

The second variable in both equations is per capita disposable income (YD) which has a negative coefficient in the utilization equation (1.1) and a positive coefficient in the total attendance equation (1.2). However, neither coefficient is statistically significant at the 95 percent confidence level. The negative coefficient for the utilization equation is further indication of the superiority of the available total attendance data to those of the average utilization rate as measures of demand. The number of performances (Q) is included in the specification of the total attendance equation (1.2) in order to stabilize or identify the demand function. The estimated relationship is both positive and statistically significant at the 95 percent level. This positive relationship is expected on theoretical grounds, but the number of performances seems to be a dominant variable in this relationship.

Turning back to the utilization equation (1.1), it is seen that the price of substitutes (PS) has a positive relationship to utilization but, while of the expected sign, this relationship with the utilization rate is not significant. By the same token, the coefficient on the price index for transportation (PCI) is positive and not significantly different from zero in equation (1.1). Unfortunately, the coefficient for this variable was expected to be negative since it was included as a measure of the price of complements rather than substitutes. The positive relationships for these price indices are not to be considered final since they are not statistically significant relationships. The capacity measure (Cty) specified in equation (1.1) was expected to exhibit a negative relationship with the utilization rate providing that shifts in the demand curve over the historical period could be accounted for. Since the estimated coefficient is positive and not significantly different from zero, it appears as if such demand shifts were not accounted for in the present specification. Finally, the negative, but statistically not significant coefficient for the crime rate index (Crm) was expected since an increase in this rate reduces attendance and thus the utilization rate. This outcome would be the result of an increase in the effective price

of attending a performance or a concert given the increased probability of being subjected to criminal activities.

(2) Cost

The cost relationship of equation (4), describes cost as a linear function of the number of performances (Q) and the hourly compensation for workers in the private non-farm sector of the economy (CMPHR). The hourly compensation measure was included to account for shifts in the cost function. The basis for these shifts was discussed by Baumol and Bowen, and Hilton, with reference to productivity gains in the performing arts, (Baumol, W. and Bowen, W., Performing Arts--The Economic Dilemma, p. 171), (Hilton, A., The Economics of the Theater, pp. 28-29). Those authors suggested that the performing arts exhibit negligible productivity gains over time, which is common in many service industries. Thus, money wage changes in the performing arts industry (stimulated by wage changes in other industries) represent real wage changes for artistic personnel which will cause upward shifts in the cost function. A likely measure of the money (and real) wage changes experienced by artistic personnel would be the hourly compensation for workers in the private non-farm sector since artistic personnel would be inclined to try to maintain their incomes relative to members of this group. Of course, this assumes that artists are successful in obtaining such wage increments in excess of productivity gains.

The estimated coefficients for both the output and wage variables are positive as expected and statistically significant at the 95 percent level. While the cost-output relationship represented by the estimates of equation (4) are only approximations of the true relationships (i.e., a cubic specification is more theoretically correct); this relationship is adequate within the observed range by reporting cost as a linear function of the number of performers and by indicating an upward shift of the cost function as real wages (i.e., the product wage) increases. More accurate and sophisticated relationships may be generated only with an increase in the number of observations.

(3) Price

The price of admission is presented in equation (5) as a linear function of the net costs of production (NC), the deficit-surplus fund as a proportion of operating budget (DSFR), and last period's admission prices. It is hypothesized that the pricing scheme exhibits a lag structure, reflecting the rigidity of the price of admission to change. The inclusion of lagged prices would account for such a rigidity, but the fewness of the observations ruled out a completed analysis. The estimated coefficient for the one lagged price which was used is negative and not statistically significant at the 95 percent confidence level. Of course, this is not a conclusive evidence against the hypothesis since various other lag structures should be investigated as data become available. It is also possible that the cost of production acted as a dominant variable which would explain most of the variation in the admission price, and cause the unstable and insignificant role for last period's price.

The cost of production used in equation (5) is net of all grants and endowment income. The estimated coefficient for this variable is positive and statistically significant. This positive relationship is in line with expectations that, as costs of production increase, unmatched by increases in grants and endowment income, pressure is created to increase the price of admission.

Finally, it was stated earlier (III.B.2) that persistent deficits will lead to upward revisions in the pricing scheme for art organizations. This was tested by including a deficit-surplus measure in equation (5) that was normalized by the sum of the operating budgets of the organizations. Again, this variable appears to suffer from the dominant variable effect of net costs which results in a positive but statistically insignificant relationship. The positive coefficient for the deficit-surplus fund variable indicates a negative relationship between the fund and prices since the fund assumes negative values. This suggests a lowering of the price as deficits increase; and vice versa, which

is contrary to expectations. On the other hand, the weak relationship might be due to increased public and private support for the arts which weaken the relationship between the deficit-surplus fund and price changes. Thus, a persistent deficit might result in a more intensive search for grants rather than price adjustments.

(4) Federal Grants

In equation (15), Federal grants are specified as a function of the number of performances (Q), and the National Endowment for the Arts appropriations (BNEA). The estimated coefficient for the National Endowment for the Arts appropriations is positive and statistically significant at the 95 percent confidence level. The significance of the funding level of the National Endowment for the Arts is not surprising since it is indicative of the commitment of the Federal government to the arts. In addition, in a model of all art forms combined a certain amount of spurious correlation may be expected between total Federal grants and the appropriations of the National Endowment. The negative, though statistically insignificant, relationship between the number of performances and Federal grants would have to be interpreted as an increase in the importance of Federal grants as a revenue source in times of financial difficulties for the arts when performances, and thus ticketed revenues, are reduced.

(5) Regional Grants

Regional grants, represented by equation (16), are a function of the number of performances (Q), the previous year's NEA appropriations ($BNEA_{-1}$), and the gross national product (GNP). Regional grants are expected to be similar to Federal grants since there is considerable interdependence between the two levels of government, and, indeed, the results of the estimation are similar to those for Federal grants. The coefficient for the previous NEA appropriations is positive and significant at the 95 percent confidence level, while the coefficients of the number of performances and the gross national product are negative and not statistically significantly different from zero. Again, if these relationships are actually negative, they would be indicative of increased regional assistance during times of economic stress (both in the

economy as a whole and for the art organization in particular) as in the case with Federal grants.

(6) Private Contributions

Private contributions in equation (17), are represented as a function of the average tax rate (t), a wealth index (SPI), and fund raising expenditures (CAdv). Each of these variables was expected to exhibit positive coefficients, but only two did so. The estimated coefficient for the average tax rate is positive and statistically significant at the 95 percent level, indicating that as the tax rate increases the net cost of a tax deductable contribution by the donor decreases so that total contributions increase. The coefficient for the wealth index, Standard & Poor's Common Stock Price Index, is also positive, but not statistically significant. Thus there may be some tendency that would be brought out with a more substantial data base for contributions to increase as gains are made in the stock market. The fund raising expenditures variable has a negative and statistically insignificant coefficient. This negative relationship might be due to a lagged response of contributions to fund raising expenditures and some of the specifications in Appendix B support this, but there were not enough degrees of freedom to thoroughly explore this issue.

(7) Foundation Grants

Foundation grants are explained in equation (19). In this specification, they are represented as a function of the capacity expansion factor (X), the ratio of the deficit-surplus fund to the operating budget (DSFR), the number of performances (Q), and a dummy variable for the years the Ford Foundations Symphony Program was in its fund matching period (DMM). The capacity expansion factor is the ratio of the desired capacity to actual capacity. The estimated coefficient for the capacity expansion factor is negative and statistically significant. This suggests that documenting the desired level of capital expansion is likely to be of little value in the solicitation of grants from foundations, and might even

indicate that the art organization is in a position where the foundation may not want to provide a grant. A surprising finding is that the coefficient on the deficit-surplus fund is positive and significant. This means that as the deficit account grows relative to the operating budget (i.e., becomes more negative), the size of the grants from foundations decline. This coefficient says that foundations tend to be more interested in special endowment programs, and the development of special art programs than in organizations in financial difficulty or in need of capital expansion. This, however, should be qualified since the deficit-surplus fund is generally negatively related to foundation grants in the individual art form models.

The coefficient estimates for the number of performances and the Symphony Program dummy variables are both positive and significant. This means that the Ford Foundation Symphony Program had a noticeable influence on total foundation grants (as expected) and that, as the number of performances increases (special programs?), the volume of foundation grants increases also.

(8) Capacity Expansion Factor

The capacity expansion factor is explained by equation (23) in table 9. This factor is defined as the ratio of desired to actual capacity of the organization, and is specified as a function of the percentage change in annual attendance (PDA). The relationship as estimated is positive and significant at a 95 percent confidence level. As it stands, this estimate represents a traditional accelerator relationship in which investment (capital expansion) is a function of the change in sales (attendance).

(9) Fund Raising Costs

Equation (27) presents annual fund raising costs as a function of last period's private contributions (CPr_{-1}), changes in the number of performances (ΔQ), and the size of the deficit-surplus fund at the end of the year (DSF). None of the coefficients are statistically significant at a 95 percent level of

confidence. The fund raising effort is a positive function of last period's contributions, indicating that success stimulates further efforts, although for this variable a negative coefficient could as easily be explained as large fund raising efforts following (or being caused by) small efforts the previous year. At the same time, as the number of performances increases (say, because of increased demand), the necessity to devote resources to fund raising is lessened.

Finally, as the deficit-surplus account grows, the estimated positive coefficient implies that efforts to raise funds decrease (recall that the deficit-surplus fund is negative). Either there is a lag structure which could not be deduced because of the lack of data, or (and this is more likely) operating cost deficits are covered by account manipulation or drawing on endowment corpus, so that the measure we have employed is a poor indicator of the actual accumulated operating deficits. More work definitely needs to be done regarding this variable, both in theoretical specification and in data editing.

(10) Subscription Sales

Subscription sales are described in equation (32). These sales are a function of the price of admission (P). The estimated coefficient is positive and statistically significant at the 95 percent confidence level. This positive relationship was expected since the higher the price level, the more significant would be the dollar discount gained by buying a subscription and the larger the proportion of subscription sales. It should be noted that the positive relationship between the price of admission and subscription sales is not likely to hold over the complete range of prices. At some point, the relationship will become negative as the positive effect of the discount given to subscription buyers (i.e., the increased proportion of subscription sales) is offset by the decrease in the total amount demanded as prices rise. The price at which this is likely to occur depends on the discount gained by subscription buyer, and the percentage of the audience

typically attending more than one performance by the given art organization.

Of course, the net positive effect of price increases on subscription sales is based on an assumption of a constant percentage discount for subscription sales (or, at best, no increase in the percentage discount) over the period studied. For All Art Form Combined, the average discount fell from 20 points in the 1965-66 year to only 15 percent in 1970-71. Clearly then, the impact of price on subscription sales as estimated above is understated rather than overstated.

b. Non-Profit Theater

The data set obtained from the Ford Foundation and used in the estimation of the model for Non-Profit Theater includes data on 26 theaters. Table 15 gives the estimates for 11 selected equations, while Table 16 provides a list of the variables used. The detailed statistical results for a review of specifications for each of the Non-Profit Theater equations are presented in Table B.18 through B.28 in Appendix B to this report. The presentation of the Non-Profit Theater model will parallel that for the all Art Forms combined model presented above. The discussion, however, will stress the differences observed between the two. In general, however, it will be shown that the results are substantially better, in terms of the proportion of variance explained, significance of coefficients, and interpretation of the results, when dealing with a specific type of arts and cultural organization than when dealing with an aggregation across several types.

(1) Demand

The two main alternative specifications for the demand function use the utilization rate of the seating capacity (AU), equation (1.1), and annual total attendance (A), equation (1.2), as dependent variables. These demand equations are specified as functions of the price of admission (P), per capita disposable personal income (YD), the price of reading and recreation (PS), the price of transportation (PC1), the unemployment rate (Um), and

TABLE 15: SELECTED ESTIMATES FOR THE NON-PROFIT THEATER MODEL[1/]

(1.1)	AU = 55.1116 + .4133 P - .0211 YD - 64.8597 PS + 337.4751 PCl - 8.5339 Um - .3101 Crm (1.4824) (.2094) (-1.8193) (-.6565) (3.7536) (-2.3161) (-4.6242)	$\bar{R}^2$ = .9035 t(.05) = 4.303
(1.2)	A = -4646603 - 150079.5 P + 750.3801 YD + 9717458 PS - 10375.5781 Crm (-3.1144) (-1.8956) (1.0904) (2.2727) (-2.9658)	$\bar{R}^2$ = .8739 t(.05) = 2.776
(4)	C = -40287104 + 6016.960 Q + 34004096 CMPHR (-3.2014) (2.4860) (5.4399)	$\bar{R}^2$ = .9037 t(.05) = 2.447
(5)	P = .7502 - 1.9257 DSFR + .00000032 NC - .2629 P_{-1} (.9369) (-.4914) (4.2071) (-.8755)	$\bar{R}^2$ = .8373 t(.05) = 2.776
(11)	GF = 702750.25 + 129.4822 Q + .0362 BNEA - 854.0784 GNP (.2628) (.4467) (2.0245) (-.4878)	$\bar{R}^2$ = .7214 t(.05) = 2.571
(12)	GR = -2148383 + 601.4163 Q - .0054 $BNEA_{-1}$ - 4635097 PDGNP + 1.1197 GR_{-1} (-1.3924) (1.8630) (-.4898) (-1.4864) (-1.3019)	$\bar{R}^2$ = .5896 t(.05) = 3.182
(13)	CPr = -14838486 - .2943 A + 1.609 CAdv + 39705993.8 t + 38081.7070 SPI (-4.1420) (-.3227) (.5589) (3.0482) (1.7801)	$\bar{R}^2$ = .9190 t(.05) = 2.776
(14)	GFn = -1296221 + 2462387 X - .4302 DSF (-.5196) (1.0210) (-3.3910)	$\bar{R}^2$ = .6556 t(.05) = 2.571
(18)	X = -.1445 + .000108 Q + .00727 AU (-.3305) (2.1123) (1.8543)	$\bar{R}^2$ = .4151 t(.05) = 2.571
(21)	CAdv = 441632.375 - 428492.625 DSFR - .0714 CPr_{-1} - 15.5919 ΔQ (5.3188) (-.6272) (-2.8563) (-1.0814)	$\bar{R}^2$ = .6081 t(.05) = 2.776
(26)	Sbr = 751574.3125 + 36464.2383 P + .6791 Sbr_{-1} - 12301.3125 Tr (1.4866) (2.1782) (3.4168) (-1.4139)	$\bar{R}^2$ = .8208 t(.05) = 2.776

[1/] The values enclosed in parentheses are the t statistics; the values t(.05) are the critical t-values at the 95 percent level; $\bar{R}^2$ is the adjusted coefficient of multiple determination. Equation numbers correspond to those presented in the conceptual modelling section, above.

TABLE 16: THE VARIABLES USED IN THE NON-PROFIT THEATER MODEL[1/]

Variable	Description
A	Annual total ticketed attendance
AU	Percent seat capacity filled
BNEA	Annual appropriations by the National Endowment for the Arts to various programs and agencies
C	Annual total operating expenditures less the costs of fund raising
CAdv	Annual fund raising costs and fees
CMPHR	Compensation per hour in private non-farm sectors, 1972=1.00, employees plus employers' contributions for social insurance and private benefit plans. Also includes an estimate of wages, salaries, and supplemental payments for the self-employed
CPr	Annual total local nongovernment contributions
Crm	Violent crime rate for the U.S. per 100,000 inhabitants, offenses of murder, forcible rape, robbery, and aggravated assault
DSF	Balance of the surplus-deficit fund at the end of the year
DSFR	The ratio of the surplus-deficit fund to the operating budget
GF	Annual federal grants
GFn	Annual foundations grants
GNP	Gross National Product in billions of 1972 dollars
GR	Annual total local government grants
NC	Annual total operating expenditures net of total unearned income (grants, contributions, and corpus earnings used for operations).
P	Average realized price of admission
PDGNP	Percentage change in the gross national product
PS	Consumer price index for reading and recreation, 1972=1.00
PCl	Consumer price index for transportation services, 1972=1.00
Q	Annual total ticketed performances
ΔQ	Change in annual total ticketed performances
Sbr	Annual total of subscriptions purchased
SPI	Standard & Poor's common stock price indexes, (500 stocks) (1941-43=10)
t	Average tax rate, ratio of the receipts of the federal, state and local government to the National Income
Tr	A trend variable, the last two digits for the year of the data
Um	Unemployment rate for whites
X	Annual seating capacity expansion factor
YD	Per capita disposable income in 1972 dollars

[1/] Monetary values are expressed in 1972 dollars.

the crime rate (Crm). In choosing between these two specifications, it is clear that the attendance specification in equation 1.2 is superior to that of the utilization rate in equation 1.1. While only one coefficient in both equations is significant at a 95 percent level of confidence (i.e., that for the crime rate), the signs of all coefficients in the attendance equation are of the expected value, whereas almost every sign is "incorrect" in the utilization equation. Attendance is negatively related to the admission price and the crime rate and positively related to income and the price of substitute goods.

(2) Cost

The cost relationship of equation (4), shows total cost as a function of the number of performances (Q) and the hourly compensation of workers in the private non-farm sector of the economy (CMPHR). The estimated coefficients are in line with expectations and are also statistically significant at the 95 percent level. That is, costs are a routine function of both output and wage increases not matched by productivity increases.

(3) Price

The price function of equation (5) presents price as a function of the net cost of production (NC), the weighted deficit-surplus fund (DSFR), and last period's admission price (P_{-1}). The estimated coefficients are of the expected signs but the only statistically significant coefficient is that for the net cost variable. That is, price appears to be increased if the accumulated deficit fund increases and the net cost of operation increases enough to offset the reluctance to raise prices indicated by the negative sign on the coefficient of the lagged price. In fact, should these quantities not increase, the tendency is to lower prices until the two sets of effects result in a stable price level.

(4) Federal Grants

Federal grants are presented in equation (11) as a function of the number of performances (Q), the NEA

appropriations (BNEA), and the gross national product (GNP). None of the coefficients is statistically significant at the 95 percent confidence level, but all of the signs are interpretable. The negative sign for the gross national product is an indication of the level of Federal support in times of financial difficulties, whereas the positive coefficients or NEA appropriations and the number of performances relate to the facts that Federal grants to theaters are made possible by the NEA appropriations and the sizes of the grants are likely to mirror the levels of activity (number of performances) in the industry.

(5) Regional Grants

The relationship in equation (12) for regional grants is similar to that of the Federal grants with the exception that last period's regional grants (GR_{-1}) was added to the equation, GNP is expressed as a percentage change (PDGNP) and the NEA appropriations ($BNEA_{-1}$) were lagged. None of the coefficients are statistically significant, but they are nevertheless interpretable. The NEA appropriations variable is negatively related to regional grants which would suggest that these appropriations replaced regional grants in many instances. The remaining coefficients suggest that governmental assistance to theaters increases in times of economic stress, that regional grants increase as industry activity increases, and that there is a tendency for regional grants to decline over time in the absence of these effects.

(6) Private Contributions

Private contributions are represented by equation (13) which specifies such contributions to be a function of total attendance (A), fund raising expenditures (CAdv), the average tax rate (t), and Standard & Poor's Common Stock Price Index (SPI). While the only statistically significant coefficient is the tax rate, all coefficients are of the expected sign, with the exception of the coefficient for total attendance. That is, private contributions are a positive function of the level of advertising for them, the tax rate faced by the prospective contributors (i.e., the value of the contributions as a tax writeoff), and the wealth of the

contributors. The negative influence of attendance is probably due to simultaneity bias in that while it was expected that contributions would increase with attendance, the need for contribution (and the level of effort expended to get them) should decrease as attendance rises.

(7) Foundations' Grants

Foundations' grants in equation (14) of Table 15 are shown as a function of the capacity expansion factor (X), and the deficit-surplus fund (DSF). The coefficient of the capacity expansion factor is not statistically significant at the 95 percent level, but its sign is positive indicating that Foundation grants may be related to the desire to expand the capital plant. The deficit-surplus fund has a statistically significant coefficient, and its negative coefficient implies that foundations help financially troubled Non-Profit Theaters (the negative coefficient is due to the negative values for the fund balances).

(8) Capacity Expansion Factor

The capacity expansion factor (equation (18)) is a function of the number of performances (Q), and the utilization rate (AU). The signs of both coefficients are in line with expectations, even though neither is statistically significant at the 95 percent confidence level. This estimated equation should be considered illustrative rather than definitive since the data are for nine years and studies of the capital adjustment process should span a longer period, but it does suggest that capital expansion is encouraged by high numbers of performances and high levels of seating capacity utilization.

(9) Fund Raising Expenditures

Fund raising expenditures are shown in equation (21) to be a negative function of the weighted deficit-surplus fund (DSFR), last period's private contributions (CPr_{-1}), and changes in the number of performances (ΔQ). While the signs of all the coefficients are in line with expectations, the only statistically

significant coefficient is that of last period's contributions. These results suggest that fund raising is accelerated as a result of an accumulated operating deficit, a drop in the number of performances, and a high level of last period's private contributions.

(10) Subscription Sales

Equation (26) shows subscription sales as a function of the admission price (P), last period's subscription sales (Sbr_{-1}), and a trend variable (Tr). The signs of the coefficients for the first two variables are both positive and are in line with expectations. That is, subscription sales increase as the ticket prices increase because of the discount associated with subscriptions (i.e., at a constant discount rate[1/] as the price increases, the amount saved via the discount increases), and it is easier to reach any specific subscription sales goal the larger last period's subscription sales (this coefficient was statistically significant). The sign for the trend variable suggests a tendency for a decline in the sale of subscriptions over time without offsetting price increases.

c. Opera

The data set obtained from the Ford Foundation and used in the estimation of this model includes a total of 28 opera companies. Table 17 presents selected estimates for the 11 behavioral equations, while Table 18 provides a list of variables in the specifications. Estimates of other specifications for these 11 equations are provided in Tables B.29 through B.39 of Appendix B to this report. While the results presented here are not as good as those reported above for Non-Profit Theater, they are better than those presented for the combined model when evaluated in terms of the expected signs and the statistical significance of the estimated coefficients.

1/ In fact, the discount rate decreased from 23 percent in 1965-66 to 16 percent in 1970-71 so that the positive impact of price is understated.

TABLE 17: SELECTED ESTIMATES FOR THE OPERA MODEL[1/]

(1.1)	AU = -3.2717 + 4.9814 P + .01427 YD - .0114 Q (-.1626) (3.4081) (4.9840) (-1.9400)	$\bar{R}^2$ = .7619 t(.05) = 2.571
(1.2)	A = -1836900 + 84690.5625 P + 57.3894 YD + 1836555 PS - 945059.5 PC1 + 0.8506 Cty (-4.7434) (3.6171) (.3459) (2.3476) (-2.2727)(11.1363)	$\bar{R}^2$ = .9918 t(.05) = 3.182
(4)	C = 3756818 + 18624.016 Q + 25611632 CMPHR (0.5087) (2.3747) (4.4037)	$\bar{R}^2$ = 0.8249 t(.05) = 2.447
(5)	P = 7.2776 + 11.30071 DSFR + 0.4378 NCA - 0.3190 P_{-1} (1.9676) (1.9581) (1.6919) (-.7934)	$\bar{R}^2$ = 0.4712 t(.05) = 2.571
(14)	GF = -1125997 + 1121.5925 Q + .0531 BNEA (-1.9605) (1.6715) (8.6029)	$\bar{R}^2$ = .9260 t(.05) = 2.477
(15)	GR = 747617.188 - 309.8127 Q + .00960 $BNEA_{-1}$ (2.9909) (-1.0345) (2.6098)	$\bar{R}^2$ = .4078 t(.05) = 2.571
(16)	CPr = 4846485 - 1.5610 A + 21.8105 CAdv + 22745081.25 t - 25940.9844 SPI (0.5715)(-0.4685) (2.4693) (0.7891) (-.3971)	$\bar{R}^2$ = 0.6928 t(.05) = 2.776
(17)	GFn = 1716448 - 2.8236 A - 1106709 X - 3247599 DSFR + 7156.3867 Q (1.3187) (-5.5401) (-2.0352) (-2.0352) (8.0744)	$\bar{R}^2$ = .9153 t(.05) = 3.182
(21)	X = -.0668 + .00244 Q + .0103 AU (-.0223) (.3006) (.2936)	$\bar{R}^2$ = Neg.[2/] t(.05) = 2.776
(24)	CAdv = 13371.453 + .0113 CPr_{-1} - 196.7127 ΔQ - .0058 DSF (.1505) (1.3543) (-6.3228) (-.6639)	$\bar{R}^2$ = .8901 t(.05) = 2.776
(29)	Sbr = -2323568 + 27651.5313 P + 0.2963 Sbr_{-1} + 31892.4023 Tr (-1.3921) (0.5061) (0.7026) (1.5858)	$\bar{R}^2$ = 0.6652 t(.05) = 2.571

[1/] The values enclosed in parentheses are the t statistics; the values t(.05) are the critical t-values at the 95 percent level; $\bar{R}^2$ is the adjusted coefficient of multiple determination; Equation numbers correspond to those presented in the conceptual modelling section, above.

[2/] Adjusted R^2 was negative which indicates a very low explanatory power for this relationship.

TABLE 18: THE VARIABLES USED IN THE OPERA MODEL[1/]

Variable	Description
A	Annual total ticketed attendance
AU	Percent seat capacity filled
BNEA	Annual appropriations by the National Endowment for the Arts to various Programs and agencies
C	Annual total operating expenditures less the costs of fund raising
CAdv	Annual fund raising costs and fees
CMPHR	Compensation per hour in private non-farm sectors, 1972=1.00. Wages and salaries of employees plus employers' contributions for social insurance and private benefit plans. Also includes an estimate of wages, salaries, and supplemental payments for the self-employed
CPr	Annual total local nongovernment contributions
Cty	Total seats available--main season and other
DSF	Balance of the surplus-deficit fund at the end of the year
DSFR	The ratio of the surplus-deficit fund to the operating budget
GF	Annual federal grants
GFn	Annual foundations grants
GR	Annual total local government grants
NCA	Annual total operating expenditures net of total unearned income per ticketed attendee
P	Average realized price of admission
PS	Consumer price index for reading and recreation, 1972=1.00
PCl	Consumer price index for transportation services, 1972=1.00
Q	Annual total ticketed performances
ΔQ	Change in annual total ticketed performances
Sbr	Annual total of subscriptions purchased
SPI	Standard & Poor's common stock price indexes, (500 stocks) (1941-43=10)
t	Average tax rate, ratio of the receipts of the federal, state and local government to the National Income
Tr	A trend variable, the last two digits for the year of the data
X	Annual seating capacity expansion factor
YD	Per capita disposable income in 1972 dollars

[1/] Monetary values are expressed in 1972 dollars.

(1) Demand

The two basic alternative specifications for the demand function are those using the utilization rate (AU), equation (1.1), and annual total attendance (A), equation (1.2). The demand equations are specified as functions of the price of admission (P), per capita personal disposal income (YD), the number of performances (Q), the prices of reading and recreation (PS) and transportation (PC1), and the total seating capacity (Cty). The signs of the estimated coefficients in both equations are in line with expectations except for the price of admission. Surprisingly, both of these coefficients are significantly positive at the 95 percent level of confidence. No explanation can be found for this phenomenon except that the other variables of the specification were not sufficient to account for demand shifts. The capacity variable in equation (1.2) and the income variable in equation (1.1), are the only other coefficients which are significantly different from zero at the 95 percent level. The problem of identification persisted even though various variables were employed in order to account for the shifts in the demand curve. A reasonable explanation for the persistence of the identification problem is that:

- opera appeals to a segment of the population that is hard to isolate from the available socioeconomic statistics. This complicates the process of identification of the demand shifts, since it is not possible to accurately measure for the factors that give rise to such shifts.
- the admission price is only part of the effective price of attendance, since various other costs are incurred in attending the Opera. Consequently, changes in the admission price are likely to be moderated by their proportion in the effective price. While this is not specific to the Opera, it, undoubtedly, contributed to the identification problem.

In summary, based on these results, the attendance equation performed substantially better than the utilization equation. This is consistent with the findings in previous models.

(2) Cost

The cost relationship of equation (4) in Table 17 specifies total cost as a function of the number of performances (Q) and the hourly compensation for workers in the private non-farm sector (CMPHR). The estimated ccefficients are in line with expectations, and the coefficient for the hourly compensation is statistically significant at the 95 percent level, indicating that costs do increase with the number of performances and that wage increases not matched by productivity increases will result in an upward shift in the cost function.

(3) Price

Price is specified in equation (5) to be a function of the net cost of production per person attending (NCA), the deficit-surplus fund weighted by the operating budget (DSFR), and last period's admission price (P_{-1}). While none of the coefficients are statistically significant at the 95 percent confidence level, all are of the expected sign, except the deficit-surplus coefficient. Recall that this same problem was encountered in the Combined model.

(4) Federal Grants

Equation (14) presents Federal grant as a function of the number of performances (Q) and the annual appropriations of the National Endowment for the Arts (BNEA). The signs of both coefficients are positive, as expected, but only the NEA appropriations coefficient is statistically significant at the 95 percent confidence level. Note that the positive relationship between Federal grants and output (performances) confirms that found for Non-Profit Theater, but not found for the Combined model.

(5) Regional Grants

The relationship between regional grants and the number of performances (Q), and last period's NEA appropriations ($BNEA_{-1}$) is shown in equation (15). Note the similarity to the

Federal grant specification of equation (14). The negative coefficient for performances in this instance, however, suggests that regional government support for the Opera is aimed at those companies with low performance levels (i.e., those that are small or in financial difficulty). It should be noted, though, that this coefficient is not statistically significant at the 95 percent confidence level. The coefficient for the lagged NEA appropriations is statistically significant at the 95 percent confidence level, which indicates the relationship of regional grants and federal support for the arts.

(6) Private Contributions

Private contributions in equation (16), are shown as a function of total attendance (A), fund raising expenditures (CAdv), the average tax rate (t), and Standard & Poor's Common Stock Price Index (SPI). All these variables would be expected to have positive coefficients. However, both total attendance, and Standard & Poor's Common Stock Price Index have negative coefficients. While none of the coefficients are statistically significant at the 95 percent level of confidence, the signs of these two coefficients are discouraging. A similar finding with respect to total attendance was observed in the Non-Profit Theater Model, but the suggestion that an increase in the Standard & Poor's Index leads to reduced contributions is difficult to rationalize. A suggestion for further research would be to attempt to include some measure of the change in tax provisions over the years in addition to the average tax rate.

(7) Foundations' Grants

Foundations' grants are a function of total attendance (A), the capacity expansion factor (X), the weighted deficit-surplus fund (DSFR), and the number of performances (Q) as shown in equation (17) of Table 17. The coefficients for total attendance, capacity expansion factor, and the weighted deficit-surplus fund are negative, while that for the number of performances is positive. These estimated relationships support the hypothesis that foundations are interested in aiding opera organizations which

are in financial difficulties (hence, the negative coefficient for the deficit-surplus fund), and operas that develop special programs, rather than trying to expand their physical plants. Again, however, the negative coefficient on attendance is difficult to interpret, even though it is not significantly different from zero in the current estimation.

(8) Capacity Expansion Factor

The capacity expansion factor in equation (21), is a function of the number of performances (Q), and the utilization rate (AU). The coefficients of both variables are positive, as expected, but the relationships are not statistically significant and the explanatory power is extremely low. Considerably more degrees of freedom are required before a reasonable set of coefficient estimates can be expected in a function to predict the desired proportional change in the capital stock of operas.

(9) Fund Raising Expenditures

Fund raising expenditures in equation (24) are a function of last period's private contributions (CPr_{-1}), changes in the number of performances (ΔQ), and the deficit-surplus fund (DSF). The only statistically significant coefficient is the negative coefficient for the change in performances. The signs of all coefficients are in line with expectations, although the sign of the coefficient for last period's private contributions is interpretable whether positive or negative. The results indicate that if performances decline or if an operational deficit exists at the end of the year, the reaction of the Opera is to expand efforts at fund raising.

(10) Subscription Sales

Subscription sales are specified as a function of the price of admission (P), last period's subscription sales (Sbr_{-1}), and a trend variable (Tr) in equation (29). While none of the coefficients is statistically significant at the 95 percent

confidence level, the signs of the price of admission, and lagged subscriptions are in line with expectations, and the sign of the trend variable is indicative of an increasing trend in the sale of subscriptions. These results are almost identical to those found for Non-Profit Theaters, above.

d. Symphony

Data sets obtained both from the Ford Foundation and the Center for Policy Research were used in estimating the Symphony model. The Ford Foundation set was used in estimating the full model, while the American Symphony Orchestra League data obtained from the Center was used in duplicating only the demand, cost, and price estimates. It should be noted that these two data sets are not for the same samples of symphonies. The Ford Foundation data include 76 symphonies, while the Center's data set includes only 17 symphonies, although the Center's data span 26 years as opposed to the nine years of the Ford Foundation data. Fortunately, the results of both sets of estimation are not only supportive of each other, but are extremely good in comparison to those of the Combined Model. Selected equation estimates (using the Ford data) for the Symphony model are presented in Table 19, and the definition of the variables used are presented in Table 20. Detailed model estimates (using the Ford data) are presented in Tables B.40 through B.50 in Appendix B.

The estimates obtained for the Symphony model are clearly the best (even better than those presented above for Opera). Most coefficients are of the expected signs and are significant at the 95 percent levels of confidence, and most of the equations have extremely strong predictive power. In addition, the estimates are extremely stable across data sets. The relative success of the Symphony is due primarily to the exceptional state of the data for this art form, which suggests that similar results can be obtained with the other models provided similar data are made available.

1/ Also as above, the subscription price discount decreased from 15 percent in 1965-66 to only 8 percent in 1970-71, so that the positive effect of price on subscription sales is understated.

TABLE 19: SELECTED ESTIMATES FOR THE SYMPHONY MODEL BASED ON THE FORD FOUNDATION DATA[1/]

(1.1)	AU = 113.8421 - 14.2125 P + .0093 YD - .0066 Q (30.1265) (-6.6200) (4.4336) (-5.1633)	$\bar{R}^2$ = .9299 t(.05) = 2.571
(1.2)	A = 6506604 - 1558514 P + 1581.6653 YD (11.9250) (-4.9660) (6.9058)	$\bar{R}^2$ = .8825 t(.05) = 2.447
(4)	C = - 13238224 + 14987.408 Q + 44645792 CMPHR (-1.4904) (3.8400) (5.6690)	$\bar{R}^2$ = .9717 t(.05) = 2.447
(5)	P = 1.0870 - 1.0815 DSFR + .3576 NCA (2.3321)(-1.0661) (5.0859)	$\bar{R}^2$ = .9678 t(.05) = 2.447
(15)	GF = 17866960 + .0628 BNEA - 15067424 PDGNP - 2.5714 A (1.5891) (2.7383) (-1.2065) (-1.5741)	$\bar{R}^2$ = .6276 t(.05) = 2.571
(16)	GR = -6608469 - .006167 $BNEA_{-1}$ + .8983 GR_{-1} + 1.0128 A (-9.5384) (-2.3494) (12.5503) (10.5393)	$\bar{R}^2$ = .9890 t(.05) = 2.776
(17)	CPr = -38136032 + 1.4087 A + 118258500 t + 24568.6094 SPI - 1.8289 $CAdv_{-1}$ (-5.8335) (1.1638) (9.8535) (.7428) (-3.1499)	$\bar{R}^2$ = .9752 t(.05) = 3.182
(18)	GFn = -9295878 + 25883168 DSFR + 2971.3708 Q + 3807020 DMM + 4015.38 ΔCty (-1.1232) (1.1921) (1.1866) (5.3511) (1.6084)	$\bar{R}^2$ = .9481 t(.05) = 4.303
(23)	X = .8426 + .000136 Q - .00453 AU (.4299) (.8390) (-.2275)	$\bar{R}^2$ = .0987 t(.05) = 2.571
(27)	CAdv = 2973070 - .1064 CPr_{-1} - 86.4703 ΔQ - .0486 DSF (1.7389) (-1.1166) (-1.1272) (-.4332)	$\bar{R}^2$ = .1329 t(.05) = 2.571
(32)	Sbr = - 3730592 + 1201811 P + .3084 Sbr_{-1} (-3.8230) (4.0213) (1.6078)	$\bar{R}^2$ = .8861 t(.05) = 2.571

[1/] The values enclosed in parentheses are the t statistics; the values t(.05) are the critical t-values at the 95 percent level; $\bar{R}^2$ is the adjusted coefficient of multiple determination. Equation numbers correspond with those presented in the conceptual modelling section, above.

TABLE 20: THE VARIABLES USED IN THE SYMPHONY MODEL IN TABLE 19[1/]

Variable	Description
A	Annual total ticketed attendance
AU	Percent seat capacity filled
BNEA	Annual appropriations by the National Endowment for the Arts to various programs and agencies
C	Annual total operating expenditures less the costs of fund raising
CAdv	Annual fund raising costs and fees
CMPHR	Compensation per hour in private non-farm sectors, 1972=1.00. Wages and salaries of employees plus employers' contributions for social insurance and private benefit plans. Also includes an estimate of wages, salaries, and supplemental payments for the self-employed
CPr	Annual total local nongovernment contributions
ΔCty	Change in total seats available-main season and other
DMM	A dummy variable for the years 1965/66 through 1970/71, the years the Ford Foundation Symphony Program was in its matching fund stage
DSF	Balance of the surplus-deficit fund at the end of the year
DSFR	The ratio of the surplus-deficit fund to the operating budget
GF	Annual federal grants
GR	Annual total local government grants
GPn	Annual foundation grants
NCA	Annual total operating expenditures net of total unearned income per ticketed attendee
P	Average realized price of admission
PDGNP	Percentage change in the gross national product
A	Annual total ticketed performances
ΔQ	Change in annual total ticketed performances
Sbr	Annual total of subscriptions purchases
SPI	Standard & Poor's common stock price indexes, (500 stocks) (1941-43=10)
t	Average tax rate, ratio of the receipts of the federal, state and local government to the National Income
X	Annual seating capacity expansion factor
YD	Per capita disposable income in 1972 dollars

[1/] Monetary values are expressed in 1972 dollars.

(1) Demand

The Ford Foundation data set was used in the estimation of two alternative demand functions. Equation (1.1) uses the utilization rate as the dependent variable, and equation (1.2) uses annual total attendance as the dependent variable. Both demand equations represent functions of the admission price (P), and personal disposable income (YD), while the utilization rate equation also includes the number of performances (Q). All estimated coefficients are of the expected signs and are statistically significant at the 95 percent confidence level. On the basis of predictive power, equation (1.1) would seem to be superior. This represents the first instance that the utilization rate equation could be chosen over the total attendance equation. Even so, the choice is marginal. Both are negatively related to price and positively related to income.

(2) Cost

The cost relationship of equation (4) in Table 19 describes cost as a function of the number of performances (Q), and the hourly compensation for workers in the private non-farm sector (CMPHR). The estimated coefficients have the expected signs and are statistically signficant at the 95 percent confidence level. Cost is shown as a routine function of output and upward shifting of the function is indicated when wage increases are not matched by productivity increases.

(3) Price

The price relationship of equation (5) shows price as a function of the weighted deficit-surplus fund (DSFR), and the net cost of production per attendee (NCA). The signs of both coefficients are in line with expectations, although only the net cost coefficient is statistically significant at the 95 percent confidence level. As expected, the tendency is for price increases to be instituted as a result of increases in the size of the accumulated operating deficit (normalized for the size of the operating budget) and increases in the cost of production per attendee. This

implies that symphonies, among other things, may try to counter the effects of declining attendance on revenues by raising prices.

Before describing the remaining equations estimated with the Ford Foundation data in Table 19, the corresponding demand, cost, and price equation estimates using the American Symphony Orchestra League (ASOL) data supplied by the Center for Policy Research will be presented. Table 19.a presents three series of such estimates and Table 20.a provides definitions for the variables used. Before describing the "best" equation specification resulting from the use of the ASOL data, however, it should be instructive to see how those equation specifications presented above perform using the ASOL data. Therefore, the same specification was estimated from the ASOL data set as was estimated from the Ford Foundation data set (see Table 19) and over the same 1965 to 1973 period. These results are presented in Table 19a and are to be compared with those on Table 19.

Because of the absence of output (Q) and deficit-surplus fund as a proportion of the operating budget (DSFR) measure in the ASOL data base (as made available to Applied Management Sciences), the length of season (LOS) measure had to be used as a proxy for the preferred output measure (the number of concerts) and the excess of annual total revenue over expenditures as a proportion of the operating budget (DSFR1) had to be used as a proxy for DSFR. In any event, since there is no certainty that the two samples represent the same universe (i.e., are equally representative of the universe), statistical tests were not performed on the pairs of equations to test for parameter equality. Rather, only the signs and the magnitudes of the estimated coefficients were compared.

It is interesting to note that the adjusted coefficients of multiple determination ($\bar{R}^2$) never vary by more than two percentage points between the two estimation sets. In addition, coefficient signs are the same for all except DSFR1 which is probably an indication of the inadequacy of this variable as a proxy for DSFR. In the attendance equation (1.2) the magnitude of the income (YD) coefficients are very similar, whereas those for

the price (P) coefficients were not. Furthermore, the price coefficient in the ASOL data estimate is not statistically significant, suggesting either price inelasticity or specification error. The inclusion of additional regressors (not shown) increased the statistical significance of the price coefficient, and produced comparable coefficient magnitudes, which suggests a specification error.

The cost equations (4) are not comparable between Tables 19 and 19.a because of the differing output measures and the fact that the output measure in Table 19.a appears to be a dominant variable. Similarly, in equation (5) the results are mixed due to the inadequacy of DSFR1 as a proxy for DSFR.

In conclusion, then, the results from the two data sets over the same period are not sufficiently comparable. This is, of course, due to the definitional differences which exist between the measures of output and deficit-surplus funds of the two samples.

An additional evaluation of the ASOL data base was undertaken by comparing the results of the regressions for the 1965-1973 data with those of the whole data set spanning the years 1950 to 1975. The estimated coefficients have the same signs, with the price coefficient in the demand equation (1.2) in Table 19.a becoming statistically significant, and all other coefficients increasing their significance levels. The values of the adjusted coefficients of multiple determination also increased especially in the case of the attendance equation (1.2). This is a clear demonstration of the value of additional degrees of freedom, and is an argument for undertaking an editing effort on the ASOL data of a magnitude comparable with that already taken on the Ford Foundation data.

The last set of regressive results presented on Table 19.a are those for the "best" specification using the ASOL data. The detailed estimates for these and similar equations are documented in Tables B.41.a through B.43.a in Appendix B.

BEST COPY AVAILABLE

(1.a) Demand

Using this alternative data base, only a total attendance equation could be estimated and presented in Table 19.a. Equation (1.2) of this table specifies total attendance as a function of price (P), per capita disposable income (YD), the price of transportation (PC1), and the price of reading and recreation (PS). All coefficients have the expected signs although only the coefficients of price and income are significant. The added observations of this data set allowed both the price of substitutes and the price of complements to enter the "best" specification, although not significantly. Note the similarity in the income coefficients between the two data sets, as further confirming evidence of the stability of the estimator for Symphonies.

(2.a) Cost

Equation (2) of Table 19.a presents the estimates for costs as a function of the length of the season in weeks (LOS) and the earnings of manufacturing workers (AWEMAN). This estimate differs from that in Table 19 because output data were not supplied with the data set. The estimated coefficients are in line with expectations, although only the length of season coefficient is statistically significant at the 95 percent confidence level. This might be the result of the aggregation of the individual length of season measures, since the larger is a symphony orchestra, the more likely it is to keep the salaries of the performing artists in line with those of other sectors of the economy. Because the larger orchestras are not given a proportionally larger weight in the data supplied, a bias is introduced in the average wage coefficient. In any event, the results of this regression confirm those using the Ford Foundation data.

(3.a) Price

The last estimate possible from the American Symphony Orchestra League data supplied to Applied Management Sciences

BEST COPY AVAILABLE

TABLE 19.a: ESTIMATES FOR THE SYMPHONY MODEL BASED ON THE AMERICAN SYMPHONY ORCHESTRA LEAGUE DATA SUPPLIED BY THE CENTER FOR POLICY RESEARCH1/

Selected Estimates Based on the 1965-1975 Data, all Estimated by Ordinary Least Squares	(1.2)	A = 701605.5625 − 1995984.1875 P + 1945.8376 YD (.2268) (−.8168) (7.1415)	R^2 = .8628 t(.05) = 2.447
	(4)	C = −343623544 + 107818.375 LOS + 1395376.369 CMPHR (−2.4110) (13.7773) (.1678)	R^2 = .9869 t(.05) = 2.447
	(5)	P = .7287 + 5.6770 DSFR1 + .0269 NCA (3.8350) (14.2645) (17.9087)	R^2 = .9737 t(.05) = 2.447
Selected Estimates Based on the 1950-1975 Data. All Estimated by Ordinary Least Squares	(1.2)	A = −922089 + 716688 P + 2513.6992 YD (−2.8947) (−3.8958) (14.4115)	R^2 = .9629 t(.05) = 2.069
	(4)	C = −28235120 + 100436.5 LOS + 1244268.422 CMPHR (−14.9101) (43.6380) (.7755)	R^2 = .9973 t(.05) = 2.069
	(5)	P = .1827 + 6.2868 DSFR1 + .9493 NCA (5.2103) (14.6506) (95.8414)	R^2 = .9985 t(.05) = 2.069
Selected Estimates Based on the 1950-1975 Data, All Estimated by the Cochrane-Orcutt Technique	(1.2)	A = −909360.1 − 595067.88 P + 1479.84 YD − 1497020 PC1 + 3727998.4 PS (−1.3239) (−3.4178) (3.2618) (−.7115) (1.3596)	R^2 = .9793 t(.05) = 2.074
	(4)	C = −27184848 + 101643.25 LOS + 352796.27 AWEMAN (−6.9991) (27.6992) (.1210)	R^2 = .9974 t(.05) = 2.069
	(5)	P = .8382 + .7490 NCA (4.6369) (17.0870)	R^2 = .9815 t(.05) = 2.064

1/ The values enclosed in parentheses are the t statistics; R^2 is the adjusted coefficient of multiple determination.

TABLE 20.a: THE VARIABLES USED IN THE SYMPHONY MODEL OF TABLE 19.a

Variable	Description
A	Annual total attendance
AWEMAN	Average gross weekly earnings for manufacturing, 1972=1.00
C	Annual total operating expenditures
CMPHR	Compensation per hour in private non-farm sectors, 1972=1.00. Wages and salaries of employees plus employers' contributions for social insurance and private benefit plans. Also includes an estimate of wages, salaries, and supplemental payments for the self-employed
DSFR1	The ratio of the excess of annual revenue over expenditures to the operating budget
LOS	Aggregated length of season for the sample in weeks
NCA	Annual total operating expenditures net of unearned income per attendee
P	Average realized admission price
PC1	Consumer price index for transportation services, 1972=1.00
PS	Consumer price index for reading and recreation, 1972=1.00
YD	Per capita disposable personal income in 1972 dollars

by the Center for Policy Research is that of the price of admission as a function of operating expenses per attendee (NCA). The coefficient shown for the per attendee operating cost in equation (3) of Table 19.a is of the expected positive sign and is highly significant, confirming the earlier results using the Ford Foundation data. It is clear that substantially better estimates may be obtained from the present models if more degrees of freedom are provided in the data.

(4) Federal Grants

Returning to the estimates based on the Ford Foundation data as presented in Table 19, Federal grants are shown in equation (15) to be a function of the annual National Endowment for the Arts appropriations (BNEA), the percentage change in the gross national product (PDGNP), and total attendance (A). All coefficients are of the expected signs but only the positive coefficient for the NEA appropriations is statistically significant at the 95 percent level of confidence. The negative coefficients for the change in GNP and total attendance indicate that Federal grants are increased in times of both general and industry-specific financial stress.

(5) Regional Grants

The relationship shown for regional grants in equation (16) is similar to that shown for Federal grants with the substitution of last period's regional grants (GR_{-1}), for the change in GNP and the introduction of a lag in the NEA appropriations ($BNEA_{-1}$). The coefficients of this specification are all statistically significant with the exception of lagged NEA appropriations. The negative coefficient for the lagged NEA appropriations suggest that regional governmental units are reacting to the NEA activities and letting the NEA bear a larger share of the support for symphonies. It is also interesting that the coefficient for attendance is positive rather than negative which would indicate that regional grants may go more to continuous support of successful symphonies rather than providing support to save financially troubled symphonies.

While this is an interesting hypothesis, it is also possible that cause and effect have not been well reported via the ordinary least squares estimation procedure in this instance.

(6) Private Contributions

Private contributions in equation (17) are shown as a function of total attendance (A), the average tax rate (t), the Standard & Poor's Common Stock Index (SPI), and last period's fund raising expenditures ($CAdv-_1$). While only the positive coefficient for the tax rate was statistically significant at a 95 percent level of confidence, the equation suggests that private contributions are expected to increase as the symphony's attendance expands and as tax rates and stock prices increase. The negative impact of last period's fund raising activities might be a result of the tendency to increase the level of such activities during periods of financial crisis when private contributions are low. This increase was suggested by P. Hart in Orpheus in the New World, p. 335.

(7) Foundations Grants

Grants from foundations are shown in equation (18) to be a function of the weighted deficit-surplus fund (DSFR), the annual number of performances (Q), a dummy variable to account for the years the Ford Foundation's Symphony Program was in its fund matching years (DMM), and annual changes in seating capacity (ΔCty). The coefficients are in line with expectations except for the weighted deficit-surplus fund variable. It is likely that the wrong sign for this variable is due to the inclusion of the dummy variable which accounts for the Ford Foundation's policy of aiding symphonies which face financial difficulties and therefore dominates the effect of the deficit-surplus fund during the very short period examined. This dummy variable is the only one which is statistically significant at the 95 percent confidence level.

(8) Capacity Expansion Factor

The capacity expansion factor in equation (23) is a function of the number of performances (Q), and the utilization rate (AU). Neither coefficient is statistically significant at the 95 percent confidence level, but only the sign of the coefficient

for the number of performances was in line with expectations. It is possible that capacity expansion is desired and undertaken in symphonies only as the funds become available, and not because of high utilization rates.

(9) Fund Raising Expenditures

Fund raising expenditures (equation (27)) are specified as a function of last period's private contributions (CPr_{-1}), changes in the number of performances (ΔQ), and the deficit-surplus fund (DSF). While the signs of the coefficients are in line with expectations, none is statistically significant at the 95 percent confidence level. Thus, it is suggested that fund raising activities for symphonies increase as performances decline and operating deficits build up, and diminish as last period's contributions increase.

(10) Subscription Sales

Subscription sales are shown in equation (32) to be a function of the price of admission (P), and last period's subscription sales (Sbr_{-1}). The signs of both coefficients are in line with expectations, but only the coefficient of the price of admission is statistically significant at the 95 percent level. These coefficients suggest that price increases cause individuals to try to take advantage of season discount prices,[1/] and subscription sales build upon the base of sales from last year.

e. Ballet

The Ford Foundation data set used in the estimation of this model includes a total of nine ballet companies. Table 21 gives the "best" estimates for 11 selected equations, while Table 22 provides a list of the variables used. The overall performance of the model was fairly good given the number of observations available. Full details on the alternative specifications estimated for each equation are presented in Tables B.51 through B.61 of Appendix B.

1/ The positive effect of prices on subscription sales is understated because of a decline in the percentage discount allowed from 21 to 19 percent from 1965/66 to 1970/71.

TABLE 21: SELECTED ESTIMATES FOR BALLET MODEL[1/]

(1.1)	AU = 45.9459 + 13.1280 P - .0469 YD + 145.5676 PS - 67.6303 PC1 (.7707) (1.7049) (-1.7342) (.7871) (-.6308)	$\bar{R}^2$ = .7677 t(.05) = 2.776
(1.2)	A = -310814.625 - 184666.6875 P + 301.3545 YD + 2235.9397 Q (-.3463) (-1.6286) (2.0385) (3.6483)	$\bar{R}^2$ = .7801 t(.05) = 2.571
(4)	C = -5204833 + 6912.608 Q + 18318240 CMPHR (-4.3903) (2.4796) (12.2584)	$\bar{R}^2$ = .9793 t(.05) = 2.447
(5)	P = -3.4473 + 13.6501 DSFR + .00000049 NC + .9463 P_{-1} (-2.1203) (4.3977) (5.3678) (4.1841)	$\bar{R}^2$ = .8756 t(.05) = 2.571
(11)	GF = 278183.0625 + 167.193 Q + .0104 BNEA (.6350) (.1894) (1.7799)	$\bar{R}^2$ = .2187 t(.05) = 2.447
(12)	GR = -975616.188 - .00344 $BNEA_{-1}$ - .9082 GR_{-1} + 1302.562 GNP - .1518 A (-4.1504) (-1.9648) (-4.1210) (5.5922) (-2.9475)	$\bar{R}^2$ = .8822 t(.05) = 3.182
(13)	CPr = -6719600 + 17359356.25 t + 20358.0742 SPI + 5.1169 $CAdv_{-1}$ (-3.6211) (3.0137) (2.6613) (2.3737)	$\bar{R}^2$ = .9801 t(.05) = 2.571
(14)	GFn = 6962447 - 3349043 X - 2620354 DSFR - 3934.603 Q (5.8111) (-4.6239) (-2.1404) (-3.5116)	$\bar{R}^2$ = .7400 t(.05) = 2.776
(18)	X = 1.7529 - .00048 Q - .00689 AU (3.6431) (-1.0435) (-.9402)	$\bar{R}^2$ = .2042 t(.05) = 2.571
(21)	CAdv = 24149.305 - 299808.688 DSFR + .0376 CPr_{-1} + 42.8505 ΔQ (.3360) (-.7232) (1.1804) (.3202)	$\bar{R}^2$ = .1919 t(.05) = 2.776
(26)	Sbr = -985746.9375 - 2467.8047 P - .7205 Sbr_{-1} + 15601.5977 Tr (-5.0655) (-.5083) (-2.2848) (5.1250)	$\bar{R}^2$ = .9625 t(.05) = 2.571

[1/] The values enclosed in parentheses are the t statistics; the values t (.05) are the critical t-values at the 95 percent level; $\bar{R}^2$ is the adjusted coefficient of multiple determination; equation numbers correspond to those presented in the conceptual modelling section, above.

TABLE 22: THE VARIABLES USED IN THE BALLET MODEL[1/]

Variable	Description
A	Annual total ticketed attendance
AU	Percent seat capacity filled
BNEA	Annual appropriations by the National Endowment for the Arts to various programs and agencies
C	Annual total operating expenditures less the costs of fund raising
CAdv	Annual fund raising costs and fees
CHPHR	Compensation per hour in private non-farm sectors, 1972=1.00. Wages and salaries of employees plus employers' contributions for social insurance and private benefit plans. Also includes an estimate of wages, salaries, and supplemental payments for the self-employed
CPr	Annual total local nongovernment contributions
DSFR	The ratio of the surplus-deficit fund to the operating budget
GF	Annual federal grants
GFn	Annual foundations grants
GNP	Gross National Product in billions of 1972 dollars
GR	Annual total local government grants
NC	Annual total operating expenditures net of total unearned income (grants, contributions, and corpus earnings used for operations)
P	Average realized price of admission
PS	Consumer price index for reading and recreation, 1972=1.00
PCl	Consumer price index for transportation services, 1972=1.00
Q	Annual total ticketed performances
ΔQ	Change in annual total ticketed performances
Sbr	Annual total of subscriptions purchased
SPI	Standard & Poor's common stock price indexes, (500 stocks) (1941-43=10)
t	Average tax rate, ratio of the receipts of the federal, state and local government to the National Income
Tr	A trend variable, the last two digits for the year of the data
X	Annual seating capacity expansion factor
YD	Per capita disposable income in 1972 dollars

[1/] Monetary values are expressed in 1972 dollars.

(1) Demand

The two alternative specifications for demand use as the measure of demand: (1) the utilization rate (AU), (equation (1.1)), and (2) annual total attendance (A), (equation (1.2)). Both demand equations are specified as functions of the admission price (P), per capita personal disposable income (YD), the price of reading and recreation (PS), price of transportation (PC1), or the number of performances (Q). The admission price and income coefficients in the utilization rate equation have signs opposite from those expected in a demand equation. Although both the price of substitutes and the price of complements do have the expected signs, in this equation, none of the coefficients are statistically significant. All the coefficients in the total attendance equation exhibit the expected signs, although the only statistically significant coefficient is that of the number of performances. Clearly, the total attendance equation is the best measure of demand.

(2) Cost

The cost relationship, represented in equation (4), shows cost as a function of the number of performances (Q) and the hourly compensation for workers in the private non-farm sector (CMPHR). The estimated coefficients are in line with expectations and are statistically significant at the 95 percent level. Again, this relationship shows that costs increase with output and that the cost-output relationship changes as productivity does not keep up with wage changes.

(3) Price

The price relationship in equation (5) specifies price as a function of the net cost of production (NC), the weighted deficit-surplus fund (DSFR), and last period's price of admission (P_{-1}). All the coefficients are statistically significant at the 95 percent confidence level, but not all are of the expected sign. For example, the lagged price was expected to be negative to indicate downward pressure on prices ceteris paribus, and the price was

expected to be negatively influenced by the deficit-surplus fund. Neither of these expectations was met.

(4) Federal Grants

The Federal grants are related in equation (11), to the number of performances (Q), and the annual National Endowment for the Arts appropriations (BNEA). Even though both coefficients have the correct signs, neither is statistically significant. Nevertheless, the relationship suggests that Federal grants to ballet are positively related to both NEA appropriation and the level of ballet activity.

(5) Regional Grants

The relationship for regional grants (equation (12)), is specified as a function of last period's NEA appropriations ($BNEA\text{-}_1$), last period's regional grants ($GR\text{-}_1$), the gross national product (GNP), and total attendance (A). Only the coefficients for last period's regional grants and gross national product are statistically significant at the 95 percent confidence level. The negative signs on attendance and lagged NEA appropriations indicate that regional grants are used for financially troubled ballet companies and that Federal and regional grants are often viewed as substitutes, respectively, while the negative coefficient for last periods regional grants suggests that regional grants exhibit cyclical behavior. The positive coefficient on GNP indicates that regional grants will be awarded to the extent the economy can finance them. It should be noted that the overall relationship for regional grants has substantial explanatory power, while that of the Federal grants does not. This might be indicative of the role each type of grant plays in the finances of the Ballet.

(6) Private Contributions

Private contributions are shown in equation (13) to be a function of the average tax rate (t), the Standard & Poor's Common Stock Price Index (SPI), and last period's fund raising expenditures ($CAdv\text{-}_1$). The signs of all the coefficients are in

line with expectations, and the coefficients of the tax rate and Standard & Poor's Index are statistically significant at the 95 percent confidence level. Clearly, private contributions to Ballet increase as taxes and the wealth of the potential contributor increase. In addition, higher contributions can be expected the greater was last periods efforts to solicit such contributions.

(7) Foundations' Grants

Foundations' grants in equation (14) are,shown as a function of the capacity expansion factor (X), the weighted deficit-surplus fund (DSFR), and the number of performances (Q). The coefficients for the expansion factor and the number of performances are statistically significant at the 95 percent confidence level. On the other hand, expectations were met with respect to signs in all cases. Thus, it is clear that foundation grants are not to be used in Ballet for increasing seating capacity, but are to be used for those in financial distress (i.e., accumulated operating deficits and decreasing performances).

(8) Capacity Expansion Factor

The capacity expansion factor of equation (18) is specified as a function of the number of performances (Q), and the utilization rate (AU). Neither coefficient was statistically significant at the 95 percent confidence level, nor were the negative signs obtained for both coefficients in line with expectations. These negative signs may indicate that capital accumulation takes place in Ballet as the funds become available, rather than being the result of an increase in the level of operations or attendance.

(9) Fund Raising Expenditures

Fund raising expenditures are indicated in equation (21). For this equation, they are presented as a function of the weighted deficit-surplus funds (DSFR), last period's private contributions (CPr_{-1}), and the change in the number of performances (ΔQ). None of the coefficients is statistically significant at the

95 percent confidence level. The signs of the weighted deficit-surplus fund and last period's private contributions are in line with expectations, indicating that fund raising is used to offset operating deficits, and success in fund raising activities, measured by the level of private contributions, increases fund raising expenditures. It is surprising to find that fund raising efforts may be stimulated by high contributions in the last period or positive changes in the number of performances (unless the performance increase is in the absence of an attendance increase).

(10) Subscription Sales

Equation (26) presents subscription sales as a function of the price of admission (P), last period's subscription sales (Sbr_{-1}), and a trend variable (Tr). The signs of the coefficients for the price of admission, and lagged subscriptions sales are not in line with expectations but, then, neither coefficient is statistically significant. It is possible that the negative effect on total demand as a result of admission price increases is greater than the positive effect gained through the discounts for subscriptions, but this is not likely. What is likely to account for the unclear price effect is the high degree of variability of the average percentage discount during the period studied. The discounts ranged from 37 percent in 1965/66 to 42 percent in 1966/67 to 21 percent in 1970/71. The trend variable, which is statistically significant, indicates a positive trend for subscription sales over the period covered, however.

f. Modern Dance

A total of only three dance companies were available from the Ford Foundation data base, and, for these three companies, some variables had as few as five observations. While some attempts to develop model estimates were made for Modern Dance, none of the results could be tested statistically. Therefore, analysis of these efforts will not be presented at this time. Should a sufficient data base be developed at a later date, results similar to those obtained for the models above could be expected from an estimation effort.

3. Museums

The model estimation for museums used the cross-sectional data set for the year 1971/72 which was obtained from the National Research Center of the Arts. (The museum time series data set, which was discussed in subsection IV.H.1, is inadequate for econometric model estimation.) This cross-sectional data set was adequate for the estimation of most of the behavioral relationships in the conceptual model, but its purely cross-sectional character necessitated the modification of the conceptual model. Lagged values and first differences were eliminated, except where the increment to a variable was identified in the data. Selected equation estimates and the corresponding variable definitions are presented in Tables 23 and 24, respectively. Additional estimates are presented in Tables B.63 through B.75 in Appendix B.

a. Programs, Publications, and Services Revenue

The conceptual model specifies programs, publications, and auxiliary services as sources of earned income for museums. These sources of revenue (OR) are specified in equation (4) as a function of the expenditures on all educational programs (CPrg), annual total attendance (A), and the membership count (M). The use of the expenditures on all educational programs rather than those for which a fee is charged (CPrg1) (as specified in the conceptual model) is due to the lack of data. This substitution does not alter the relationship if the ratios of free and paid admission programs are comparable among the various museums.

The estimated coefficient for the programs expenditure variable (CPrg) is positive, greater than unity and statistically significant at the 95 percent level of confidence. The second variable in the equation is annual total attendance (A). This variable also has a positive and statistically significant coefficient at the 95 percent confidence level. It indicates an increase in revenue as general attendance increases because attendance for educational programs and the demand for auxiliary services are also likely to rise as a result.

TABLE 23: SELECTED ESTIMATES FOR THE MUSEUM MODEL[1/]

(4)	OR = -70404.8724 + 1.2697 CPrg + .3907 A - 1.7810 M (19.5999) (10.6918) (-.2025)	$\bar{R}^2$ = .7648 F = 267.6679
(5)	M = 1561.6949 + .00053 TR - .00322 ΔS - .00039 DSF + 7.6324 PM (7.3505) (-2.5524) (-2.3362) (.7694)	$\bar{R}^2$ = .1551 F = 19.5807
(7)[2/]	A = - 247252.7277 + 1115.1566 Q + 117.2346 YD + .7948 ΔS - 63607.5604 PA (7.8223) (1.9055) (1.5093) (-1.1221)	$\bar{R}^2$ = .2339 F = 19.6286
(8)	PA = .3005 + .1098 NCA + .0745 DSFR (9.6758) (4.1602)	$\bar{R}^2$ = .2478 F = 49.0999
(12)	GF = - 124185.7868 + .8956 A + 2.3990 CPrg - 2407.1829 Q + .9610 π - .2248 DSF (8.1183) (6.8508) (-5.1569) (4.2875) (-1.9013)	$\bar{R}^2$ = .6408 F = 29.8940
(13)	GR = - 148247.3113 + .3768 A + 425.0754 Q + 57.1380 YD (11.1196) (3.9161) (1.4258)	$\bar{R}^2$ = .4484 F = 73.6301
(14)	CPr = 54183.3697 + 689.1118 Q + .3922 CPrg - 1.0660 CAdv - .2468 ΔS + 312728.1852 t - 10.6594 YD (6.6573) (5.0031) (-3.2198) (-1.0564) (.5779) (-.2811)	$\bar{R}^2$ = .5492 F = 49.3331
(15)	GFn = 58339.39 + .0528 A + .0251 DSF + 58.8916 Q + .0461 ΔS + .0107 CPrg (1.4973) (1.0918) (.5701) (.1789) (.1549)	$\bar{R}^2$ = .0260 F = 1.7485
(20)	CP = 126770.4913 + 4136.6917 Q (20.6971)	$\bar{R}^2$ = .4108 F = 428.3702
(22)[3/]	CPrg = 5211.0242 + .2656 G + .0191 DSF - 3.1545 M (14.3450) (1.0977) (-.5020)	$\bar{R}^2$ = .4811 F = 85.9705
(25)	CRs = 133302.7954 - .7472 ΔS (-1.5356)	$\bar{R}^2$ = .0045 F = 2.3583
(26)	CAdv = 1835.6665 + .0332 G + .0084 DSF (12.1639) (3.0496)	$\bar{R}^2$ = .4067 F = 99.3609
(32)	ΔS = - 8392.8319 - .0712 YE - .0294 CPr + 6876.8341 US (-7.6818) (-2.6111) (.7635)	$\bar{R}^2$ = .1417 F = 29.4042

[1/] The values enclosed in parentheses are the t statistics; the critical value for all the equations at the 95 percent confidence level is 1.96; $\bar{R}^2$ is the adjusted coefficient of multiple determination; F is the F statistic for the overall relationship. Equation numbers correspond with those presented in the conceptual modelling section, above.

[2/] This combines equations (7) and (10) since no separate data are available for annual general attendance.

[3/] This is equations (35) and (36) combined according to equation (22).

TABLE 24: THE VARIABLES USED IN THE MODEL FOR MUSEUMS[1/]

Variable	Description
A:	annual total attendance
CAdv:	annual advertising and promotional expenditures
CP:	annual operating, production, costs
CPr:	annual private contributions.
CPrg:	annual educational and other group program costs
CRs:	annual costs of research activities
DSF:	deficit-surplus fund
DSFR:	the ratio of the deficit-surplus fund to the operating budget
G:	annual total grants
GF:	annual federal grants and support
GFn:	annual foundation grants
GR:	annual state and local grants and support
M:	membership count
MA:	annual membership attendance
NCA:	net operating cost per attendee
OR:	sum of program, publications, and services revenue
PA:	price of admission
PM:	membership price, dues
Q:	output, in terms of weighted (8-hours) days of operations, the weight is the ratio of administrative expenditures to average expenditures by all museums
ΔS:	change in the stock of exhibit items and facilities, this variable does not account for deaccessions
TR:	annual total earned and unearned income
t:	the average (individual) federal tax rate for the population of the state where the museum is located
US:	ratio of utilized to total stock of exhibit items
YD:	per capita disposable personal income of the population in the state
YE:	endowment income
π:	surplus revenue

[1/] All monetary values are in current dollars since the model uses cross-sectional data for 1971/72.

The coefficient for the membership count (M) variable is negative, but not statistically significant. The sign of this coefficient would suggest that the higher the membership count, the less likely a museum is to depend on programs, publications, and auxiliary services as a source of revenue. While members often receive free admission privileges to some programs and are also provided with some free auxiliary services, it is unlikely that an increase in membership will result in a decline in the revenue represented by equation (4). Thus, the preferred interpretation is that for the present the coefficient on the variables is not significantly different from zero, although further work is suggested along these lines.

b. Membership Count

The membership of a museum is likely to be secularly stable as a result of having previously identified a set of interested individuals who are not likely to change their tastes in the absence of large price, income, or museum operations changes. Unfortunately, much of this type of information is not available in the present data set, so the membership count (M) relationship was respecified with the explanatory variables being the change in the stock of exhibit items (ΔS), total revenue (TR), the deficit-surplus fund (DSF), and current membership dues (PM). The estimated relationship of equation (5) shows an unexpected negative coefficient for the change in exhibit items and an unexpected positive coefficient for membership dues. Of the two, only the former has a statistically significant coefficient at the 95 percent level of confidence. It is possible that the unexpected negative coefficient for the change in exhibit items is due to the measure used. Only accessions are included in the measure of this variable as dictated by the available data. The positive coefficient for membership dues is also not in line with expectations.

An outward shift in the demand for memberships and/or a relative increase in the privileges associated with memberships takes place, the greater is the size of the museums operations. Therefore, total revenue was included in the specification. The

estimated coefficient was both positive and significant as expected, but the demand curve was not stabilized sufficiently to reverse the signs of these coefficients. The negative (and significant) sign on the deficit-surplus fund indicates that membership increases are likely to be due to a deteriorating financial condition of the museum. Normally one would want to use the level of promotional activities (which may be stimulated by a deteriorating financial condition but more directly influence the success of a membership drive) rather than the deficit-surplus fund, but a measure for this activity was not available.

c. Annual Total Attendance

The conceptual model specified a general attendance demand function, but, since total attendance must have membership attendance subtracted from it in order to calculate general attendance and since membership attendance data were not available (only membership counts are available by cell intervals), total attendance was used in the demand function. Equation (7) specifies annual total attendance (A) as a function of the output level as measured by the weighted hours of operation (Q), per capita disposable personal income of the population in the State (YD), the change in the stock of exhibit items (ΔS), and the price of admission (PA). This equation is a demand function for the output of museums, so that the coefficients for the income, output, and the change in exhibit items are expected to be positive and the price coefficient is expected to be negative. Equation (7) on Table 23 shows that all coefficients are in line with expectations, although only the output variable (Q) has a statistically significant coefficient at the 95 percent confidence level. The overall relationship explains approximately 25 percent of the variation in attendance, which suggests that variation in attendance among museums is dependent on factors that are peculiar to the individual museums.

d. Price of Admission

The price of admission (PA) is specified in equation (8) as a function of the net operating cost per attendee (NCA), and the ratio of the deficit-surplus fund to the operating budget (DSFR).

The estimated relationship is similar to the results obtained for other non-profit organizations, where the net cost variable was the dominant factor. The coefficient for the net cost per attendee is positive and statistically significant at the 95 percent level of confidence. The coefficient for the ratio of the deficit-surplus fund to the operating budget is also positive and statistically significant at the 95 percent level. This variable was expected to have a negative coefficient, since a deficit was expected to stimulate an increase in the price of admission. The positive coefficient estimate may be a reflection of the cross-sectional nature of the data whereby museums of certain types may charge higher admission prices and, at the same time, have positive deficit-surplus funds.

e. Federal Grants

The federal grants in equation (12) are specified as a function of annual total attendance (A), expenditures on educational programs (CPrg), weighted hours of operation (Q), surplus revenue (π), and the deficit-surplus fund (DSF). The coefficients for all the variables are in line with expectations, and all are statistically significant at the 95 percent confidence level, except for the deficit-surplus fund coefficient which is significant at the 90 percent confidence level. The basis for this relationship is the support of federal agencies of larger museums, as is usually indicated by total attendance and hours of operation. Expenditures on educational programs often reflect the degree of support from the public sector, and thus are positively related to federal grants. The positive relationship for surplus revenue indicates an association between the operation of the museum and the Federal support it receives. At the same time, the deficit-surplus coefficient indicates that Federal aid is provided to those museums which are having the largest deficits.

f. Regional Grants

The regional, state, and local government grants (GR) are specified in equation (13) as a function of annual total

attendance (A), the weighted number of hours of operation (Q), and per capita disposable income (YD). Regional grants would be expected to increase with both attendance and the weighted hours of operation, as well as disposable personal income (higher income increases the ability of state, regional, and local governments to support the arts because of an expanding tax base). The coefficient estimates are all in line with expectations, although only those of attendance and the weighted hours of operation are statistically significant at the 95 percent confidence level.

g. Private Contributions

Private organizations (CPr) are described by equation (14) as a function of the level of operations (as measured by both the weighted hours of operation (Q), and expenditures on educational programs (CPrg)), advertising expenditures (CAdv), changes in the stock of exhibit items (ΔS), the average individual Federal tax rate for the State (t), and per capita disposable personal income for the State (YD). Positive relationships were expected between private contributions and both measures of the level of operations. The estimated coefficients were positive, and statistically significant at the 95 percent confidence level, for both the weighted hours of operation and the expenditures on educational programs. The expenditures on advertising also were expected to have a positive coefficient since such expenditures are intended to promote the museum and its activities, but the estimated coefficient is not in line with expectations (although statistically significant at the 95 percent confidence level). This negative coefficient might be the result of the aggregation of both fund-raising and promotional activities expenditures, or because of a lag in the response of contributors which cannot be properly measured by the use of one period's data. Another possible explanation might be found in substantial advertising by those museums which are experiencing a decline in contributions. All of the above explanations are as yet untested so that more data are needed before this negative relationship can be fully explained.

The negative coefficient for the change in the stock of exhibit items is not surprising since a successful and expanding museum might not receive large private contributions but rely instead on a previously acquired endowment and/or substantial current attendance. In any case, the negative coefficient for (ΔS) is not statistically significant at the 95 percent level of confidence. The coefficient for the average tax rate is positive though not statistically significant. This relationship meets expectations since the higher the average tax rate, the lower the price of private tax-deductible contributions. The negative income coefficient is not in line with expectations, but is not statistically significant. This relationship might suggest the identification of an income measure specific to contributors, rather than assuming their incomes are correlated with the average income in the area.

h. Foundation Grants

Equation (15) specifies foundation grants (GFn) as a function of annual total attendance (A), the deficit-surplus fund (DSF), weighted hours of operation (Q), changes in the stock of exhibit items (ΔS), and expenditures on educational programs (CPrg). The individual relationships are too weak and the proportion of variation explained is too low to warrant serious analysis.

i. Annual Operating Expenditures

Annual operating expenditures in equation (20), are a function of only the weighted hours of operation (Q). The estimated coefficient is positive and statistically significant at the 95 percent level as expected.

j. Expenditures on Educational Programs

The expenditures on total programs (CPrg), as presented in equation (22), are the sum of equations (35) and (36) of the conceptual model. Since it was not possible to separate total expenditures as to free and paid admission programs, equation (22) was redefined as a behavioral equation summing equations (35)

and (36). These expenditures are specified as a function of annual total grants (G), the deficit-surplus fund (DSF), and the membership count (M). It is expected that the greater the levels of grants and the surplus from previous and current operations, the higher the total expenditures on educational programs. This would be the result of either stipulations by the providers of the grants or the current financial ability of the museum to undertake such expenditures on its own. The estimated coefficients are in line with expectations, even though the grants coefficient is the only one that is statistically significant at the 95 percent level of confidence.

The coefficient for the membership count is expected to be positive since members are likely to demand a variety of programs by the museums (i.e., a variety of programs may be necessary to attract and retain paid members). However, a negative, but statistically not significant, coefficient is actually observed for this variable.

k. Annual Cost of Research Activities

Annual costs of research activities of equation (25) are specified as a function of the change in exhibit items (ΔS). (The data were inadequate for a more thorough investigation of this cost component.) The expectation is that expanding museums are the ones likely to undertake research activities. More importantly, an increase in the stock of exhibit items both stimulates and requires accelerated research activities. Unfortunately, the estimated relationship is quite weak.

l. Annual Advertising and Promotional Expenditures

The annual advertising and promotional expenditures (CAdv) of equation (26) are a function of annual total grants (G), the deficit-surplus fund (DSF), and membership count (M). The estimated coefficient for annual total grants is positive and statistically significant at the 95 percent level. This positive

relationship was expected since those museums which receive grants for special projects are likely to increase their promotional activities with respect to those projects. The positive coefficient for the deficit-surplus fund, which is also statistically significant, suggests that advertising is undertaken if the museum is in a favorable financial situation. This is contrary to expectations. It is likely that the inability to differentiate between fund-raising and advertising expenditures is the cause of the positive coefficient for the deficit-surplus fund.

m. Change in the Stock of Exhibit Items

The change in the stock of exhibit items (ΔS) is presented in equation (32) as a function of endowment income (YE), annual private contributions (CPr), and the utilization rate of the stock of exhibit items (US). Only the positive coefficient for the utilization rate meets expectations as the other coefficients are negative, the negative coefficient on endowment income significantly so. This anomalous behavior might be peculiar to the cross-sectional data used, or the capital accumulation process for museums where acquisition is dependent on the availability of the item of interest and not strictly on the level of available funds.

VII. TREND MODEL ESTIMATION AND FORECASTING

A. Introduction

Using the trend modelling approach (see Appendix C), models were estimated for selected variables in each of the following art forms:

- For-Profit Theater,
- Non-Profit Theater,
- Opera,
- Symphony,
- Ballet,
- Modern Dance,
- All Non-Profit Art Forms Combined (Excluding Museums),
- Museums.

These models were estimated in order to generate short-run forecasts of the related variables. Therefore, forecasts of only one and two years are presented for each variable in each model. In most cases, the data series terminate in 1974 so that the forecasts will be for 1975 and 1976, but for some art forms different years are used. This situation will be described in more detail with respect to each of the models as they are presented, and is determined by the composition of the data source or sources used.

Models were estimated from a variety of data sources as indicated in Table 25. Note that in the cases of Non-Profit Theater and Symphony, two sets of models were possible due to the existence of alternative data sets.

The estimation process was preceded by the identification of the appropriate data transformation and lag scheme for constructing each trend model. The examination of the appropriate data transformation was accomplished in most cases by initially computing the autocorrelations for both the time series and the series' first differences. These autocorrelations measure the relationship between a given observation and the previous period's observations for the same phenomenon. Once the autocorrelations were calculated, a Chi-square statistic

was computed to test whether these autocorrelations were statistically significant at a specified level of confidence. (If the Chi-square statistic is significant, then higher order differences or other transformations should be used in calculating the autocorrelations.) Thus, the objective was to identify that transformation which yields autocorrelations that are not statistically significant.

Once the appropriate differencing scheme is determined, the lag structure has to be identified. Overparameterization is often suggested as a means of identifying the lag scheme for the model. This is accomplished by specifying several models spanning periods of varying lengths, and using the shortest period which minimizes the residual sum of squares. Another approach to the identification of the lag structure is to search for a regular pattern in the autocorrelations.

The problems encountered when using the overparameterization approach are those of parameter redundancy and convergence. The parameter redundancy arises because one model might be reduced to a simpler one by an appropriate transformation. The convergence problems might occur if non-linear least square procedures are used in the estimation of the model. (This last problem can be used as an indication of the appropriate lag to use, since a given model which cannot be estimated because of convergence problems, is obviously inappropriate and the number of parameters should be reduced.)

The shortcomings of this identification process are related to the selection of the data transformations which will be examined. Since the analysis does not rely on theoretical foundations, but merely examines the behavior of a given time series, the choice of the data transformation is to some extent arbitrary. Thus, it is always possible that the transformation chosen is not the most suited one for the data on hand.

Following the model identification process, estimation was undertaken based on the minimization of the residual mean squared error $\hat{\sigma}_u^2$.[1/] Lastly, the model was then used to produce short-term forecasts.

[1/] The residual mean squared error is the sum of the squares of successive disturbance terms (u) divided by the number of degrees of freedom.

TABLE 25: DATA SETS AVAILABLE FOR EACH ART FORM

Art Form	DATA SOURCES			
	Ford Foundation	Theater Communications Group[1/]	Applied Management Sciences	American Symphony Orchestra League
For-Profit Theater			X[2/]	
Non-Profit Theater	X	X		
Opera	X			
Symphony	X			X[4/]
Ballet	X			
Modern Dance	X			
Museums			X[3/]	

[1/] Put into machine readable form by Touche-Ross Co.

[2/] Data used from each of several sources:
New York City Cultural Council, Study of the New York Theater - Basic Report, Part II, January 1972; Council of Economic Advisors, Economic Report of the President, 1972; Moore, T.G., The Economics of the American Theater, 1968; Poggi, J., Theater in America: The Impact of Economic Forces, 1968; Variety.

[3/] With the assistance of the Center for Policy Research.

[4/] As received from the Center for Policy Research.

These forecasts are produced in a recursive process, in which the values of the estimated parameters (shown for each model in the tables presented below) are used as inputs, along with the original series of observations, into a forecasting algorithm obtained from the Academic Computing Center, The University of Wisconsin, Madison.

In evaluating these forecasts, it was possible, for selected variables, to compare the Box-Jenkins forecasts with trend projections obtained from the Ford Foundation. Such comparisons were, of course, possible only for forecasts based on data supplied by the Ford Foundation, but since this was the primary data base used, comparisons were possible for every model except For-Profit Theater and Museums.

B. For-Profit Theater

As indicated in Table 25, the estimation of the Box-Jenkins models for variables in this art form was based on data assembled by Applied Management Sciences from a number of sources. As such, the data series vary substantially, in terms of the period covered, among the several variables. Table 26 presents not only the period covered by the data for each of 15 variables, but also the estimated model parameters and the estimated standard error of the disturbance term.[1/]

One of two models was used for each of the variables. The model represented by equation (1) is a three-period autoregressive/one-period moving average model of variations from the series mean, whereas the model represented by equation (2) is a one-period autoregressive/three-period moving average model of variations from the series mean:

$$(1)\quad \dot{Z}_t = \phi_1 \dot{Z}_{t-1} + \phi_2 \dot{Z}_{t-2} + \phi_3 \dot{Z}_{t-3} + u_t - \theta_1 u_{t-1}$$

and

$$(2)\quad \dot{Z}_t = \phi_1 \dot{Z}_{t-1} + u_t - \theta_1 u_{t-1} - \theta_2 u_{t-2} - \theta_3 u_{t-3}$$

where

[1/] The square root of the estimated mean squared error of the disturbance term $\left(\hat{\sigma}_u^2\right)$.

BEST COPY AVAILABLE

TABLE 26: ESTIMATED BOX-JENKINS MODELS FOR THE FOR-PROFIT THEATER (BROADWAY)[1/]

Variable	Autoregressive Parameters			Series Mean	Moving Average Parameters			Disturbance Standard Error	Observed Data Interval
	ϕ_1	ϕ_2	ϕ_3	μ	θ_1	θ_2	θ_3	$\hat{\sigma}_u$	
1) Box Office Receipts for Four Weeks in February for All Shows in 1966 Dollars (1000's)	.6628	------	------	3335.5	-.0603	-.0717	.1654	503.7	1927-1965
2) Box Office Receipts for Four weeks in February for Plays in 1966 Dollars (1000's)	.8296	-----	-----	1567.8	.7752	.1465	.1668	293.5	1927-1965
3) Box Office Receipts for Four Weeks in February for Musicals in 1966 Dollars (1000's)	.6324	-----	-----	1338.9	-.2195	-.1549	-.2124	434.9	1927-1965
4) Estimated Average February Weekly Attendance for All Shows in (1000's)	.3551	.1720	-.1995	1558.1	-.3739	-----	-----	24.1	1927-1968
5) Estimated Average February Weekly Attendance for Plays in (1000's)	.8786	-----	-----	81.0	.7517	.0584	.2989	16.8	1927-1968
6) Estimated Average February Weekly Attendance for Musicals in (1000's)	1.3745	-.2045	-.1997	91.7	1.0612	-----	-----	15.4	1927-1968
7) Average Weekly Audience Size Per Performance for All Shows in February in (1000's)	-.1705	1.0050	.0177	16.9	-1.1450	-----	-----	2.9	1927-1968
8) Total Number of Performances for the Season (All Shows)	.4598	.3141	-.3247	8841.0	-.1441	-----	-----	852.7	1927-1969
9) Average Realized Price for All Shows	.6441	-----	-----	5.5110	.5038	-.0715	-.5021	.6	1927-1965
10) Average Realized Price for Plays	.6851	-----	-----	4.4886	.4372	-.0217	-.2534	.5	1927-1965
11) Average Realized Price for Musicals	.8275	-----	-----	5.3259	.2922	-.4137	.4186	.7	1927-1965
12) Total Number of All Shows Playing for the Season	.8705	-----	-----	75.2810	.6607	.2720	.1872	11.2	1927-1969
13) Average Run for Plays Opening During the Season (Performances)	1.0459	-----	-----	41.2940	.9082	-.1550	.2642	23.7	1927-1961
14) Average Run for Musicals Opening During The Season (Performances)	.9939	-----	-----	1282.4	.9620	.0810	-.0956	125.2	1927-1961
15) Number of Theater Weeks on Broadway for All Shows	.5147	.0189	-.0164	1175.3	-.6022	-----	-----	83.1	1927-1974

[1/] Data acquired by Applied Management Sciences from a number of separate sources (see footnote 2/ on Table 25).

$\dot{Z}_t = Z_t - \mu$

Z_t : the observation for a given variable,

μ : the estimated series mean for the variable,

$\phi_1, \phi_2, \ldots$: autoregressive parameters,

$\theta_1, \theta_2, \ldots$: moving average parameters,

u_t: disturbance term.

BEST COPY AVAILABLE

Of course, the choices between these models were based on the identification process described above. (Note that Table 26 indicates a 2 to 1 preference for the one-period autoregressive/three-period moving average model for the variables shown.)

Interpretation of the model results as shown in Table 26 is difficult without reference to the detailed modelling description presented in Appendix C and to complicated computational procedures not presented in Appendix C. Nevertheless, one can get a feel for the accuracy of the forecasts from these parameters by comparing the mean of the series and the disturbance standard error. The mean gives one a feel for the magnitude of the variables involved, whereas the confidence limits are a direct function of the square of the disturbance standard error (along with the sum of the square of the other parameter values).

Using the parameter estimate of Table 26, six-year forecasts were made for each of the 15 variables and presented in Table 27. While considerable variation was found in the data series intervals used to generate the models, each model was estimated from the full-time series available, and these estimates (i.e., those of Table 26) used to generate forecasts uniformly from 1962 to 1967 for all variables. This allows comparisons among the several forecasts which would not have been possible if forecasts were made independently for each variable beyond its observed data series.

Also note that this is the only art form for which forecasts were made for more than two years. This was undertaken for two reasons: 1) no independently generated forecasts were available for For-Profit Theater for comparison; and 2) the forecasts of six years provided an opportunity to display the cyclical variation in the Box-Jenkins forecasts as opposed to the monotonically increasing or decreasing forecasts of most trend projections.

Finally, comparisons were <u>not</u> made between these forecasts and observed data, since all observed data were used in the estimation process and the "best" model was chosen on its ability to track historical values. Therefore, using the historical values to validate the model in this instance would involve circular reasoning.

TABLE 27: FORECASTS OF FOR-PROFIT VARIABLES USING BOX-JENKINS MODEL ESTIMATES

Variable	YEAR OF THE FORECAST					
	1962	1963	1964	1965	1966	1967
1) Box Office Receipts for Four Weeks in February for All Shows in 1966 Dollars (1000's)	3893.5	3623.9	3503.4	3446.7	3409.2	3384.4
2) Box Office Receipts for Four Weeks in February for Plays in 1966 Dollars (1000's)	1586.4	1571.4	1554.5	1556.7	1558.6	1560.2
3) Box Office Receipts for Four Weeks in February for Musicals in 1966 Dollars (1000's)	2126.8	1890.1	1665.8	1545.6	1469.6	1421.6
4) Estimated Average February Weekly Attendance for All Shows in (1000's)	163.9	156.9	153.7	153.7	154.5	155.4
5) Estimated Average February Weekly Attendance for Plays in (1000's)	76.6	80.0	78.8	79.0	79.3	79.5
6) Estimated Average February Weekly Attendance for Musicals in (1000's)	98.1	95.4	94.2	93.1	92.3	91.8
7) Average Weekly Audience Size Per Performance for All Shows in February in (1000's)	16.7	19.4	16.4	19.5	16.0	19.6
8) Total Number of Performances for the Season (All Shows)	8983.8	8777.8	8789.3	8750.1	8802.8	8812.3
9) Average Realized Price for All Shows	6.06	5.95	5.72	5.65	5.60	5.57
10) Average Realized Price for Plays	4.84	4.95	4.89	4.76	4.68	4.62
11) Average Realized Price for Musicals	5.73	5.34	5.43	5.41	5.39	5.38
12) Total Number of All Shows Playing for the Season	78.1	80.3	80.4	79.7	79.2	78.7
13) Average Run for Plays Opening During the Season (Performances)	171.8	162.4	173.6	179.6	186.0	192.6
14) Average Run for Musicals Opening During the Season (Performances)	345.9	351.0	356.7	362.3	367.9	373.4
15) Number of Theater Weeks on Broadway for All Shows	1116.1	1131.2	1149.6	1151.0	1152.0	1152.7

Reference to Table 27 shows that, by and large, the projections have cyclical properties. Two notable exceptions are variables (13) and (14) which seem to "explode" unreasonably. Clearly, these forecasts lead to substantial errors over time. Reference to Table 26

explains why. In both cases, the sum of ϕs are near to or greater than 1, which is indicative of an explosive forecast.

Closer inspection of other forecasts demonstrates remarkable intervariable correspondence. For example, variable (1) shows continuously declining box office receipts and yet the corresponding attendance variable (4) shows cyclical behavior in the forecast. These would appear to be inconsistent, except that variable (9) shows a non-linear decline in the price of admission which compensates for the trend difference between variables (1) and (4).

C. All Non-Profit Art Forms Combined (Excluding Museums)

A total of 15 variables were selected for trend forecasting with the Ford Foundation data (i.e., all of the non-profit art forms except Museums use the same 15 variables).[1/] The model parameters for each of the variables are presented in Table 28. Note that the same model is used for all variables (and, indeed, for all of the art forms except Museums): a two-period auto-regressive/one-period moving average model. Also note that the observations are not measured as variations from a series mean, but rather the observations are first differences. This model was chosen so as to provide the greatest number of degrees of freedom consistent with identification and estimation since only nine years of data were available.

Table 28 also provides one and two-year forecasts using both the Box-Jenkins models and growth rates supplied by the Ford Foundation. Mean differences between these estimates were then calculated for each variable using the Ford Foundation forecasts as the base. These percentage differences range from a negative 24.2 percent to a positive 160 percent, with several differences (5 out of 12) being around 10 percent or less. The extremes are represented by number of subscriptions sold and corpus transfers, respectively. By and large,

---

1/ The Ford Foundation Codes for these 15 variables are as follows: (1) 1160, (2) 1220, (3) 1224-1226, (4) 1230, (5) 1250, (6) 1275, (7) 1290, (8) 2085, (9) 2150, (10) 2320, (11) 2330, (12) 2360, (13) 2390, (14) 3290, and (15) 3140.

TABLE 28: BOX-JENKINS MODEL ESTIMATES AND FORECASTS AND FORD FOUNDATION GROWTH MODEL FORECASTS FOR ALL ART FORMS COMBINED[1/]

Variable	Autoregressive Parameters		Moving Average Parameter	Disturbance Standard Error	FORECASTS				Average[2/] Percentage Difference
					Box-Jenkins		Ford Foundation		
	ϕ_1	ϕ_2	θ_1	$\hat{\sigma}_u$	1974/75	1975/76	1974/75	1975/76	
1) Total Earned Income	-.1890	.4249	-2.3189	2,829,000	89,518,060	90,355,780	92,058,587	97,058,587	-10.49
2) Private Contributions	.6084	.9138	2.2383	1,775,600	48,320,720	56,030,720	41,550,673	45,330,123	16.74
3) Foundation Grants	.8965	-.4302	1.9321	813,370	8,033,690	7,526,465	N/A	N/A	N/A
4) Federal Grants	1.2486	.3807	1.8741	501,740	10,431,680	15,092,820	6,635,859	8,373,657	41.20
5) Regional Grants	-.2750	.9135	-1.5484	231,830	3,823,650	3,629,376	N/A	N/A	N/A
6) Total Grants	1.5450	-.2781	2.8464	828,170	19,661,490	25,931,140	12,391,545	13,529,957	43.15
7) Grants and Endowment Income	.7852	.5028	-2.0300	1,452,200	87,870,060	102,661,000	71,959,160	79,261,575	20.63
8) Total Artistic Salaries	-.0705	.5974	-2.5385	1,029,100	76,146,660	77,741,890	76,264,577	81,040,265	- 2.22
9) Total Nonartistic Salaries	.7016	-.1982	- .1360	658,140	16,275,230	16,222,690	17,539,971	18,884,059	-12.08
10) Total Nonsalary Costs	.3973	.1143	-2.4659	1,162,900	50,136,110	50,824,420	49,777,254	52,855,479	- 1.66
11) Total Operating Expenditures	.1303	.3968	-1.9250	3,778,400	164,612,100	167,030,200	167,200,000	178,810,000	- 4.33
12) Net After Income and Corpus Transfers	-.7910	-.5041	3.1391	446,400	2,168,177	1,361,068	- 567,308	-1,559,711	160.27
13) Deficit--Surplus Fund	-.1256	-.2416	- .1996	2,446,200	5,845,593	6,043,594	N/A	N/A	N/A
14) Average Realized Ticket Price	.7573	-.5710	2.1972	.1457	4.0308	4.0995	4.3880	4.5199	- 9.56
15) Subscriptions Sold	.7215	-.0712	3.1423	172,510	1,826,342	1,834,855	2,087,399	2,459,979	-24.20

[1/] All estimates were made every nine years of data supplied by the Ford Foundation for the period 1965/66 to 1973/74; all monetary estimates in 1967 dollars; model includes Non-Profit Theater, Opera, Symphony, Ballet and Modern Dance.

[2/] Mean percentage difference between the Box-Jenkins and the Ford Foundation forecasts for the 1974/75 and 1975/76 seasons were made, using the Ford Foundation forecasts as the base.

cost predictions were closer than were income and contribution predictions, although grants were the most difficult revenue sources to obtain agreement on.

Just over half of the projections via the Box-Jenkins technique were less than those via Ford Foundation growth rates, but the negative differentials were substantially smaller in magnitude than the positive differences observed. This is because of the relatively high forecasts of grants and corpus transfers via the Box-Jenkins technique.

Thus, when dealing with the more volatile variables, substantial projection differences are observed. It is precisely in these variables that extrapolation should be the least suited and for which Box-Jenkins is ideally suited. Certainly, in the case of corpus transfers, it is the extrapolation forecast which is most likely to be in error, since its forecasts are negative.

D. Non-Profit Theater

The first of the individual non-profit art forms to be discussed relative to trend modelling is the Non-Profit Theater. The variable list and model selection procedure parallels that of the All Art Forms Combined model above. Therefore, the format and context of Table 29 for the Non-Profit Theater parallels that of Table 28.

The range of differences between the forecasts of the Box-Jenkins models and the exponential growth rate models extends from a negative difference of 80 percent (total earned income) to a positive difference of 74 percent (corpus transfers). Nine out of the 12 comparisons indicate that the Box-Jenkins models project quantities less than those of the growth models, and only three of the differences are less than 10 percent. This indicates that the correspondence between the two forecasting techniques is less for this individual art form than for all art forms combined. Again, however, the greatest correspondence is for cost items as opposed to revenue items. In fact, the forecasts for non-artistic salaries are extremely close on average, even though different trends are evidenced between the two models.

TABLE 29: BOX-JENKINS MODEL ESTIMATES AND FORECASTS AND THE FORD FOUNDATION GROWTH MODEL FORECASTS FOR NON-PROFIT THEATER[1/]

Variable	Autoregressive Parameters		Moving Average Parameter	Disturbance Standard Error	FORECASTS				Average[2/] Percentage Difference
					Box-Jenkins		Ford Foundation		
	ϕ_1	ϕ_2	θ_1	$\hat{\sigma}_u$	1974/75	1975/76	1974/75	1975/76	
1) Total Earned Income	.8689	-1.1606	.03303	2,866,100	5,907,600	9,865,052	13,980,194	14,417,215	-80.04
2) Private Contributions	-.1072	.3660	-2.1702	749,010	4,028,825	4,828,824	4,583,779	5,021,209	- 8.44
3) Foundation Grants	.6733	- .3731	2.9821	247,180	2,81[illegible],310	2,560,656	N/A	N/A	N/A
4) Federal Grants	-1.0014	- .4276	-2.9942	158,540	1,333,060	1,134,990	1,694,020	1,935,722	-31.34
5) Regional Grants	- .3607	.5778	-2.6232	86,386	1,107,024	1,013,531	N/A	N/A	N/A
6) Total Grants	1.5484	- .5703	1.7141	374,380	4,936,839	5,797,342	3,439,201	3,812,733	32.44
7) Grants and Endowment Income	1.4070	- .1471	2.4457	666,290	15,334,890	19,250,020	11,046,739	12,251,828	32.63
8) Total Artistic Salaries	- .2845	.5574	-3.1524	427,980	8,467,559	8,548,576	8,353,676	8,689,243	-51.67
9) Total Nonartistic Salaries	1.0899	- .5110	-3.6297	53,617	4,229,582	4,121,451	4,184,744	4,444,951	- .16
10) Total Nonsalary Costs	.7271	- .7101	- .1138	1,727,400	8,036,372	8,488,750	12,302,582	12,760,484	- 3.34
11) Total Operating Expenditures	.7769	- .5495	- .1399	3,187,400	22,881,140	22,285,810	28,941,448	30,018,647	-30.54
12) Net After Income and Corpus Transfers	-.1190	- .7831	-5.3688	328,000	455,674	148,068	87,281	70,068	73.94
13) Deficit--Surplus Fund	.2036	- .1461	3.0120	217,490	637,209	648,524	N/A	N/A	N/A
14) Average Realized Ticket Prict	.9793	-1.2278	.2786	.4439	2.6049	3.5709	4.9905	5.1035	-63.44
15) Subscriptions Sold	.6956	- .3538	.4128	35,951	243,426	236,438	272,097	291,693	-17.49

[1/] All estimates were made using nine years of data supplied by the Ford Foundation for the period 1965/66 to 1973/74; all monetary estimates are in 1967 dollars.

[2/] Mean percentage differences between the Box-Jenkins and the Ford Foundation forecasts for the 1974/75 and 1975/76 seasons were made, using the Ford Foundation forecasts as the base.

Touche-Ross Co. prepared a partially updated Non-Profit Theater file by adding information supplied by the Theater Communication Group to the Ford Foundation data base. Such update included two more years of data, but for only eight of the variables shown on Table 29 and for only 21 non-profit theaters. The results of using this data base are shown on Table 30. Unfortunately, the reduced number of theaters and the varying forecast years make line-by-line comparisons between Tables 29 and 30 difficult. In any event, only in the instance of Regional Grants did the trend established on Table 29 using the Ford Foundation data not continue on Table 30 when using the Theater Communications Group update. This is probably due to the fact that a noticeable upward displacement in the data was observed for this variable when adding the additional two years of data. This created the positive trend displayed on Table 30 as opposed to the negative trend on Table 29, and is probably the result of not being able to repeat a series of detailed Ford Foundation data editing steps for the last two observations (i.e., the Theater Communications Group update data).

E. Opera

When examining the two sets of forecasts for Opera, a different pattern is displayed than formerly. That is, Table 31 shows that the correspondence between the two sets of forecasts is much closer than that displayed for all art forms combined, rather than being further apart as was the case for Non-Profit Theater. While only ten of the 15 variables were forecast by both models, the range of forecast differences was from a negative 37 percent in the case of total grants to a positive difference of 25 percent for private contributions. Only three of the differences were within ten percent of each other, but seven were within 20 percent. Eight of the ten were negative differences, indicating that the Box-Jenkins model consistently forecasts values of lesser magnitude than does the exponential trending. Again, however, the two sets of forecasts are closer for cost items than for revenue items.

TABLE 30: BOX-JENKINS MODEL ESTIMATES AND FORECASTS FOR NON-PROFIT THEATER[1/]

Variable[2/]	Autoregressive Parameters		Moving Average Parameter	Disturbance Standard Error	FORECASTS	
					Box-Jenkins	
	ϕ_1	ϕ_2	θ	$\hat{\sigma}_u$	1967/77	1977/78
Total Earned Income	-.2938	-.3632	-2.6487	365,640	10,725,640	10,667,780
Individual and Corp. Donors	-.1460	.5461	2.2555	122,810	1,142,199	1,381,845
Private Foundations Income	.5902	.1067	1.9817	151,800	1,265,612	1,285,628
Federal Government Income	.6233	.0257	.2129	170,690	1,172,584	1,172,836
State and City/County Govt. Income	.2316	-.0747	- .2447	116,960	616,653	617,364
Total Unearned Income	-.3984	.7037	-2.2287	247,920	5,066,684	5,621,333
Artistic Salaries/Fees	-.5554	.4692	-2.6070	308,290	4,559,672	4,850,815
Total Operating Expenses	.0956	-.0492	-2.5982	474,750	16,781,260	16,752,740

[1/] All estimates were made using eleven years of data on 21 theaters--the Ford Foundation data plus two additional years of data from the Theater Communications group (prepared by Touche-Ross Co.).

[2/] The numbers in parentheses following the variable names reference the variable's position on Table 29.

TABLE 31: BOX-JENKINS MODEL ESTIMATES AND FORECASTS AND THE FORD FOUNDATION GROWTH MODEL FORECASTS FOR OPERA[1]

Variable	Autoregressive Parameters		Moving Average Parameter	Disturbance Standard Error	FORECASTS				Average[2] Percentage Difference
					Box-Jenkins		Ford Foundation		
	ϕ_1	ϕ_2	θ_1	$\hat{\sigma}_u$	1974/75	1975/76	1974/75	1975/76	
1) Total Earned Income	3.8556	- .2239	3.6916	909,480	23,803,810	23,705,230	25,056,341	26,993,697	- 9.56
2) Private Contributions	1.0207	.8339	1.7580	1,152,200	17,255,380	21,993,420	13,861,030	15,510,354	25.17
3) Foundation Grants	.2361	- .2161	- .3587	340,290	1,461,738	1,458,298	N/A	N/A	N/A
4) Federal Grants	.4600	.2935	2.5959	160,890	1,954,063	2,094,104	N/A	N/A	N/A
5) Regional Grants	- .3890	.2328	2.3404	30,954	541,547	494,494	N/A	N/A	N/A
6) Total Grants	.2602	- .0897	2.7451	290,600	2,540,455	2,532,749	3,269,661	3,697,529	-37.09
7) Grants and Endowment Income	.4415	.7590	.4048	2,376,900	21,257,230	23,332,800	19,377,824	21,942,091	7.33
8) Total Artistic Salaries	-.8565	.3945	-1.8625	1,046,400	16,860,140	17,411,010	18,103,367	19,596,098	-10.00
9) Total Nonartistic Salaries	.3989	-.2533	.1670	293,560	3,986,901	4,029,998	4,505,648	4,954,501	-18.00
10) Total Nonsalary Costs	.6058	.0473	.1465	1,064,900	11,927,620	12,249,330	11,632,707	12,571,932	- .11
11) Total Operating Expenditures	-.1628	.0939	-2.9965	1,090,400	40,497,740	40,492,740	43,912,206	47,882,309	-13.34
12) Net After Income and Corpus Transfers	.9985	- .7245	- .2799	932,310	1,712,951	909,509	N/A	N/A	N/A
13) Deficit--Surplus Fund	-.9282	-1.5729	- .6857	1,131,400	3,841,211	4,952,578	N/A	N/A	N/A
14) Average Realized Ticket Price	.2254	.3383	2.5853	.2299	7.3302	7.3104	7.6006	7.7961	- 5.16
15) Subscriptions Sold	.0660	.0364	- .1311	110,800	371,578	371,694	444,842	552,734	-34.21

[1] All estimates were made using nine years of data supplied by the Ford Foundation for the period 1965/66 to 1973/74; all monetary estimates are in 1967 dollars.

[2] Mean percentage differences between the Box-Jenkins and the Ford Foundation forecasts for the 1974/75 and 1975/76 seasons were made, using the Ford Foundation forecasts as the base.

F. Symphony

Table 32 presents both sets of forecasts for symphonies, again based on data supplied by the Ford Foundation for nine consecutive years. In this instance, 11 of the 15 variables for which Box-Jenkins forecasts were made also had growth rates supplied by the Ford Foundation. A quite different pattern of forecast comparisons is evident from Table 32. All of the positive differences except one are very large (ranging from 33 percent to 67 percent), and all of the negative differences are very small (only one negative difference is greater than 10 percent). Actually, what makes the pattern different is the strict dichotomy of difference sizes rather than the identification of items associated with negative and positive signs. Again, the cost items forecasts are always very close in value, with a tendency for the Box-Jenkins forecasts to be less than the extrapolations; whereas the forecasts of revenue items are quite different, with Box-Jenkins forecasts being the larger.

Additional data on symphonies were obtained from the Center for Policy Research. These data were edits of the American Symphony Orchestra League data on 17 of the over 100 symphonies reporting to them. The data supplied, covered a 26-year period from the 1949/50 season to the 1974/75 season. Table 33 presents the Box-Jenkins forecasts of all 11 variables supplied to Applied Management Sciences.

Since many more observations were available in this data set, two different models were attempted and the "best" was chosen based on the sizes of the disturbance term standard errors. The models attempted were a three-period autoregressive/one-period moving average model of variations from the series mean and a one-period autoregressive/two-period moving average model of variations from the series mean. Seven out of the 11 variables achieved better results with the first of these two model specifications.

While two-year forecasts are made for each of the variables, little comparative evaluation can be done because of the non-correspondence of the sample (and in some cases, variable definitions)

TABLE 32: BOX-JENKINS MODEL ESTIMATES AND FORECASTS AND THE FORD FOUNDATION GROWTH MODEL FORECASTS FOR THE SYMPHONY[1/]

Variable	Autoregressive Parameters		Moving Average Parameter	Disturbance Standard Error	FORECASTS				Average[2/] Percentage Difference
					Box-Jenkins		Ford Foundation		
	ϕ_1	ϕ_2	θ_1	$\hat{\sigma}_u$	1974/75	1975/76	1974/75	1975/76	
1) Total Earned Income	.2623	.3700	-2.1146	521,840	40,612,720	41,389,360	39,790,163	41,429,916	- .95
2) Private Contributions	2.0893	.0024	2.0871	1,415,200	26,039,870	36,417,330	20,022,806	21,439,219	33.62
3) Foundation Grants	- .1283	-.0422	- .3894	1,621,700	261,573	264,696	N/A	N/A	N/A
4) Federal Grants	2.8540	-.3102	2.8284	517,070	2,461,934	5,242,584	N/A	N/A	N/A
5) Regional Grants	.3494	-.7081	- .4331	176,210	1,294,556	1,169,915	N/A	N/A	N/A
6) Total Grants	1.5078	.2562	2.2808	623,350	7,175,392	10,741,310	4,017,752	4,278,040	53.73
7) Grants and Endowment Income	.6716	.2148	2.5931	1,105,400	34,383,220	35,653,410	34,133,573	37,057,797	- 1.65
8) Total Artistic Salaries	.8102	-.0140	2.0883	965,920	42,390,340	42,949,310	43,013,288	45,370,417	- 3.57
9) Total Nonartistic Salaries	.1656	.2338	- .0257	236,330	6,887,496	6,929,571	7,093,485	7,528,741	- 5.83
10) Total Nonsalary Costs	.9561	-.5698	- .4420	728,510	17,796,700	17,215,920	20,103,014	21,318,241	-18.30
11) Total Operating Expenditures	-.2846	.7476	-2.4175	1,240,100	78,666,750	81,263,620	77,461,408	82,313,591	0.10
12) Net After Income and Corpus Transfers	-1.6684	-.3389	-2.9164	252,740	2,641,999	- 661,249	1,748,815	1,556,515	66.87
13) Deficit--Surplus Fund	.5492	-.2616	.2943	746,250	2,554,954	2,417,116	N/A	N/A	N/A
14) Average Realized Ticket Price	.63758	.0063	3.3345	.0416	2.9268	2.9259	3.0164	3.1054	- 4.60
15) Subscriptions Sold	2.0558	.4413	3.5810	224,440	2,536,980	4,812,440	1,288,660	1, 555,632	61.30

[1/] All estimates were made using nine years of data supplied by the Ford Foundation for the period 1965/66 to 1973/74; all monetary estimates are in 1967 dollars.

[2/] Mean percentage differences between the Box-Jenkins and the Ford Foundation forecasts for the 1974/75 and 1975/76 seasons were made, using the Ford Foundation forecasts as the base.

BEST COPY AVAILABLE

TABLE 33: BOX-JENKINS MODEL ESTIMATES AND FORECASTS FOR SYMPHONIES[1/]

	Autoregressive Parameters			Series Mean	Moving Average Parameters		Disturbance Standard Error	Forecasts	
Variable	ϕ_1	ϕ_2	ϕ_3	μ	θ_1	θ_2	$\hat{\sigma}$	1975/76	1976/77
1) Total Gross Earned Income	.3387	.6332	.0081	-7,802,500	-1.2260	-----	680,880	29,947,460	31,575,340
2) Endowment Income	1.0385	-----	-----	-1,413,100	- .7881	.5922	376,300	7,967,856	8,328,914
3) Total Grants, Endowments, Campaigns and Projects Income	1.8790	-.7524	-.1344	13,583,000	1.1508	-----	1,818,100	30,422,960	31,198,660
4) Total Gross Expenditures	1.1964	.1804	-.3732	216,500,000	- .2717	-----	1,428,400	61,663,250	63,664,910
5) Average Weekly Salary (Artistic Personnel)	.9788	-----	-----	479.8100	.9234	-1.2058	4.78	307.9895	311.6282
6) Net Cost of Operation	.3584	.6879	.0405	192,630	-1.3333	-----	892,280	32,775,540	34,653,180
7) Net Cost of Operation Per Attendee	.9490	-----	-----	5.3300	.2620	- .1465	.19	4.78	4.81
8) Price of Admission	.4376	.1622	.2986	4.8466	- .0009	-----	.20	4.45	4.47
9) Annual Total Attendance	.4990	.4558	.1324	1,353,900	- .4735	-----	255,170	6,719,075	7,020,696
10) Number of Plays	.9910	-----	-----	2194.9	.0989	.3236	10.40	1649.83	1654.74
11) Length of Season	.9635	.7528	-.7157	654.69	- 1.2199	-----	12.40	823.52	825.79

[1/] Estimates are based on American Symphony Orchestra League data for 17 symphonies over 26 years (1949/50 to 1974/75) supplied by the Center for Policy Research; all monetary estimates are in 1972 dollars.

with the Ford Foundation data.[1/] Validation must await the acquisition of historical data subsequent to those employed in the model estimation. All of the forecasts are, however, internally consistent as expected.

G. Ballet

Box-Jenkins forecasts were made for Ballet using the Ford Foundation data base. These estimates were then compared to the forecasts made by using the Ford Foundation growth rates. In 12 out of the 15 variables, a comparison between forecasts was possible as shown on Table 34. The percentage forecast differences ranged from a negative 41 percent in the case of Federal grants to a positive seven percent in the case of grants and endowment income.

The pattern of comparisons between the two sets of forecasts for Ballet is distinctive. Even though the small percent error for corpus transfers is due to very large offsetting differences for each of the forecast years, the pattern is truly distinctive in that nine of the 12 differences are negative, and the negative differences are larger in absolute value than the positive differences. The Box-Jenkins method for Ballet forecasts lower values for expenses than does extrapolation, as expected, but many of the revenue items are also associated with negative differences. Not only are the revenue differences negative, they are more negative (greater in absolute value) than the expenditure variable differences. Thus, while larger differences for revenue items were expected, the signs of these differences were not expected and represent a reversal of the pattern established by all other art forms.

H. Modern Dance

It was originally intended that forecasts would be made for Modern Dance organizations, but this was found to be unrealistic. First of all, only three usable organizations were present in the

---

1/ In addition, the monetary estimates are in 1972 constant dollars, rather than 1967 constant dollars.

TABLE 34: BOX-JENKINS MODEL ESTIMATES AND FORECASTS AND THE FORD FOUNDATION GROWTH MODEL FORECASTS FOR BALLET[1/]

Variable	Autoregressive Parameters		Moving Average Parameter	Disturbance Standard Error	FORECASTS				Average[2/] Percentage Difference
					Box-Jenkins		Ford Foundation		
	ϕ_1	ϕ_2	θ_1	δ_u	1974/75	1975/76	1974/75	1975/76	
1) Total Earned Income	.4559	.3385	-3.0123	158,460	8,106,916	8,055,734	8,905,310	9,801,451	-15.74
2) Private Contributions	.7877	.2631	2.0191	356,640	2,949,481	3,033,898	3,168,025	3,717,329	-15.07
3) Foundation Granst	.2350	-1.1682	4.0629	178,990	1,219,042	792,770	N/A	N/A	N/A
4) Federal Grants	-.5371	- .7979	- .3476	130,340	464,250	611,182	711,402	806,480	-41.14
5) Regional Grants	-1.3001	- .4961	-2.4773	34,309	152,622	167,351	N/A	N/A	N/A
6) Total Grants	- .0423	- .0874	- .1260	409,280	1,374,136	1,376,036	1,592,181	1,805,120	-23.53
7) Grants and Endowment Income	- .2995	1.0912	-2.1234	472,500	7,956,102	8,840,395	7,309,643	8,291,693	7.12
8) Total Artistic Salaries	1.6805	- .3865	1.9985	238,210	6,970,642	7,850,464	6,523,381	7,264,894	6.77
9) Total Nonartistic Salaries	- .2805	.3601	- .2799	66,254	1,459,538	1,468,895	1,679,913	1,944,415	-23.76
10) Total Nonsalary Costs	.1540	.1005	2.4764	178,550	4,779,858	4,771,533	5,227,787	5,614,434	-13.51
11) Total Operating Expenditures	- .5207	.5689	-1.8151	438,850	14,540,120	14,550,010	15,838,042	17,557,262	-14.80
12) Net After Income and Corpus Transfers	-1.4691	- .3591	-1.3810	196,420	670,008	124,162	429,461	314,507	6.32
13) Deficit--Surplus Funds	.1715	- .7517	- .1798	620,260	1,019,311	1,419,250	N/A	N/A	N/A
14) Average Realized Ticket Price	.4372	- .6232	.1198	.3149	4.8683	4.7502	4.9774	5.2488	-6.32
15) Subscriptions Sold	.3588	.5058	3.0534	5238.9	88,206	91,216	100,268	123,964	-24.97

[1/] All estimates were made using nine years of data supplied by the Ford Foundation for the period 1965/66 to 1973/74; all monetary estimates are in 1967 dollars.

[2/] Mean percentage differences between the Box-Jenkins and the Ford Foundation forecasts for the 1974/75 and 1975/76 seasons were made, using the Ford Foundation forecasts as the base.

BEST COPY AVAILABLE

BEST COPY AVAILABLE

Ford Foundation data base and many of the variables for these organizations had as few as five observations which precluded Box-Jenkins model estimation. At the same time, a number of variables had data gaps which invalidate the Box-Jenkins modelling procedure.

I. Museum

The final type of arts and cultural organizations for which data were available to estimate trend models for individual variables was Museums. Applied Management Sciences, in cooperation with the Center for Policy Analysis, acquired annual data from 14 separate museums for the period 1950-1970. Thus a time series of 21 observations became available for trend modelling on six variables. The results of these modelling efforts are presented on Table 35 for the six variables.

Two models were attempted for each variable: a two-period autoregressive/one-period moving average model of variations from the series mean and a one-period autoregressive/two-period moving average model of variations from the series mean. The choice between the two for each variable was made on the basis of the standard error of the disturbance term. In four out of six instances, the second of the two models fit the "best."

Since the model was not estimated on the basis of Ford Foundation data, no independently generated growth rates are available for comparison. Nevertheless, it is interesting that the one- and two-year forecasts for each of the six variables indicate a remarkable stability. Some increase is predicted for each variable, but all are less than three percent, except for state and local governmental grants which is expected to be the most volatile of the six. Revenues are predicted to grow by 2.6 percent, whereas costs are expected to increase by only a quarter of a percent. Thus, the net income position of the museums is predicted to improve. Finally, it is interesting how stable the annual private contribution predictions are. While some increase is predicted, it represents only a 0.15 percent change.

TABLE 35: BOX-JENKINS MODEL ESTIMATES AND FORECASTS FOR THE MUSEUM TIME SERIES[1/]

	Autoregressive Parameters		Series Mean	Moving Average Parameters		Disturbance Standard Error	Forecasts		
Variable	ϕ_1	ϕ_2	μ	θ_1	θ_2	$\hat{\sigma}_u$	1971	1972	Percent Change[2/]
1) Annual Total Earned and Unearned Income	1.1002	-.0858	-27,212,000	.4219	-------	3,993,400	38,708,610	39,758,700	2.0
2) Annual Total Costs	.9852	-------	43,200,000	10,281	.2754	11,970,000	36,744,400	36,840,050	0.26
3) Total Funds	.5075	.5179	-89,105,000	-1.1568	-------	9,667,200	85,938,060	87,580,050	1.9
4) Annual Total Grants	1.0313	-------	4,021,400	1.0161	.3139	2,143,100	12,308,630	12,568,100	2.11
5) Annual State and Local Government Grants	1.1312	-------	4,116,300	.9047	.3562	256,540	8,009,270	8,520,036	6.38
6) Annual Private Contributions	.9466	-------	56,729,000	.7649	-.1055	2,339,490	5,521,620	5,529,705	0.15

[1/] All estimates were made using data obtained from individual museums by Applied Management Sciences and the Center for Policy Research. These data covered a 20-year period (1950 to 1970) for 14 museums and all monetary figures are expressed in 1967 dollars.

[2/] Percent change from 1971 to 1972 using 1971 as the base year.

VIII. SUMMARY AND CONCLUSION

A. Introduction

In order to establish the reactions and responsive behavior of various types of arts and cultural organizations over the economic cycle, the component parts of each organizational type must be examined in detail. For example, a common theme throughout this study has been the allegation of negligible productivity gains for the performing and visual arts organizations and a concomitant upward pressure on the salaries and cost of personnel and equipment. This is contrasted with the rigidity of the price of admission either on "moral" grounds or because of competition from the mass media. Thus, it is claimed that art organizations are being squeezed by the increasing cost of operation and as a result of their reluctance to raise the price of admission in order to increase earned income. It is suggested that the financial difficulties of these organizations are not unlike those of the handicraft industry which is "technology stagnant" and must compete with mass produced substitutes. Furthermore, given the goal of maximizing attendance at a planned zero profit level set by most of these art organizations, reserves may not be built up in "good times" to help carry them through the "bad times." Hence, a substantial reliance would be placed on unearned income sources, both public and private.

These unearned income sources may often represent the only cushions in times of financial difficulties for art organizations, in addition to being viewed as subsidies to offset part of the costs of operation. The significance of this type of income has certainly increased since 1965, when the National Endowment for the Arts, as well as most of the State Arts Agencies, were established. This year also saw an increase in the role of foundations as the Ford Foundation introduced its Symphony Program.

This brief outline of the perceived financial state-of-the-art organizations suggests two interrelated questions for the policy-makers, as well as current and potential contributors:

- what actions should each type of art organization undertake so that it can both achieve its declared objective(s) and at the same time avert financial difficulties, and

- what actions should the contributors, both public and private, undertake to assist various types of art organizations in the above task?

In answering these two questions, still others are raised for each type of art organization:

- What are the effects of economic fluctuations at the national and regional levels on attendance? (e.g., What are the effects of changes in the per capita disposable income and the unemployment rate on attendance?)
- How responsive is attendance and earned income to variations in the price of admission?
- What are the effects of changes in the prices of complementary services, substitutes, and factors such as the crime rate on attendance?
- What is the effect of inflationary pressures on the cost of production and in turn the price of admission?
- What are the factors that determine the various components of public, Federal, state, and local, grants, to what degree are these grants interdependent, and how sensitive are they to economic fluctuations?
- What are the determinants of private contributions, and how sensitive are these contributions to changes in economic conditions (wealth and income effects, as well as changes in the tax rates)?
- What determines the level and the recipient of foundation grants? Are these grants the last resort for failing art organizations?

The next logical step is to decide what analytical techniques can be employed in order to address these and other questions, and to decide whether such questions even need to be answered in order to provide policy guidance for the Arts Endowment.

B. Methodological Approaches

In order to address these questions, two separate but related approaches were attempted. The first was the development of behavioral models which, when fully estimated, would describe organizational reactions to a number of specific influences, and be useful for policy decisions by producing both long- and short-term forecasts. The second approach was an attempt to "short-cut" the behavioral modelling by generating short-term trend forecasts using a Box-Jenkins approach. While there is some truth to the contention that these two approaches are substitutes, in reality

the two approaches are more complementary than substitutes. Trend projections are short-term and involve unconditional forecasts, whereas behavioral model projections are long-term and involve conditional forecasts. Both can be used either jointly or separately for policy making.

1. Econometric Modelling

The development of behavioral models using econometric techniques involved three individual tasks: (a) conceptual model development, (b) data base acquisition and preparation, and (c) model estimation and analysis. Each of these tasks will be briefly described, in turn.

a. Conceptual Model Development

While the design of an econometric model can be characterized as the expression of the key behavioral (structural) relationship of the economic unit being considered in terms of mathematical relationships, the process is not straightforward. First, the behavioral relationship to be modelled must be discerned either by direct observation, by reference to the previous research efforts of others, or by translating the descriptions of experts (non-economic) in the area.

In the present case, the last two sources were used almost exclusively. A thorough literature search was undertaken and a panel of expert arts and cultural organization consultants was convened three separate times during the model building tasks. As described earlier, these experts included:

- Mr. Thomas Fichandler, who is currently the Executive Director of the Arena Stage, the President of the League of Resident Theaters, and the Vice-President of the Washington Drama Society.
- Mr. James Morris, who is currently the Director of the Division of the Performing Arts at the Smithsonian Institution. Mr. Morris' past experience includes a wide and varied background in the performing arts.
- Mr. Donald Nicholas, who is currently the Deputy Director of the Virginia Museum of Fine Arts. His main activities are in the area of business management.

In addition, Mr. Harold Horowitz, Director of the Research Division, National Endowment for the Arts and Mr. David Waterman, a Research Economist in the Research Division participated in these meetings.

The choice of which of the known relationships to be included in the modelling effort must then be made on the basis of the questions to be answered. Relationships that are not relevant to the hypothese to be tested, or are not necessary to establish other relationships that are, can be excluded from the set of mathematical relationships. In other words, each model was tailored to the set of hypotheses or policy questions deemed most important.

Once the relevant structural relationships have been identified, the decision can be made regarding the art forms to be modelled. That is, on the basis of the structural relationships identified,[1/] the number and types of models necessary to cover the seven separate art forms can be determined. It was originally intended that four models would adequately cover the range of art forms, but after full consideration, it was decided to construct a separate model for each type of arts and cultural organizations.[2/] The art forms included were:

- For-Profit Theater
- Non-Profit Theater
- Symphony
- Opera
- Dance
- Ballet
- Museum

In most of these decisions, the data also played a very important role. The nature of the data will influence both the range and types of relationships to be modelled, as well as the

---

1/ Also important in making this decision is the availability and nature of the data for each art form, see below.

2/ In addition, an attempt was made to model all non-profit art forms combined (excluding museums), but the results were less satisfactory than with individual models.

techniques used to statistically estimate the relationship.[1/] It was determined quite early that a primary reliance would be placed on aggregate time-series data to the extent possible. In this manner, lagged relationships could be modelled and first differences could be used in the specifications.

Having acquired all the necessary information, seven conceptual models were designed--one for each type of organization--which incorporated those relationships relevant to the hypotheses to be tested or policy questions to be answered and which were structured to accommodate as closely as possible the data that were available. Care was taken, however, to ensure that the conceptual models are complete and sufficient to provide guidance in the future collection of data in spite of the current lack of data. That is, conceptual modelling was completed for model components where data do not currently exist, and important variables were specified in relationships even though measures for them were not currently available.

b. Data Base Acquisition and Preparation

The second step in this approach was to acquire as much data as possible and to prepare data sets for use in generating statistical estimates of the relationship described by each of the conceptual models. A number of data sources were identified and data acquired accordingly:

(1) For-Profit Theater

Time series data were acquired from a number of sources and compiled by the staff of Applied Management Sciences. Of primary importance was the Black Report (New York Cultural Council, A Study of the New York Theater); Baumol and Bowen (Baumol, W. and Bowen, W., Performing Arts-The Economic Dilemma); Moore (Moore, T.G. The Economics of the American Theater); Poggi (Poggi, J., Theater in America: The Impact of Economic Forces); and data from various issues of Variety Magazine.

[1/] A discussion of this point will be found, below.

(2) Non-Profit Art Forms (Excluding Museum)

The nine years of data from the Ford Foundation constituted the most important data base acquired for Non-Profit art forms (excluding museums). A time series was formed by aggregating all of those organizations by type for which all nine years of data were available. In addition to the Ford Foundation, two other important data sources were employed. Touche-Ross & Co. acquired two years of data from the Theatre Communications Group (obviously for Non-Profit Theater only) which were then concatenated with the corresponding organizations on the Ford Foundation File. Thus, an eleven-year time series was created by aggregating those non-profit theaters for which all eleven years of observations were available.

Lastly, limited data (both in terms of number of organizations and number of variables) were obtained from the Center for Policy Research on symphonies. These data were partially edited observations from the extensive data maintained by the American Symphony Orchestra League. It was felt that both the Theatre Communications Group data and the American Symphony Orchestra League data would prove useful in at least partially verifying the results from the Ford Foundation data in view of the greater degrees of freedom permitted by these data sets.

(3) Museum

Two data sets were developed for museums. The first is a time series of data acquired from the financial reports of individual museums through the joint efforts of Applied Management Sciences and the Center for the Arts. Unfortunately, the first set proved to be composed of largely imcompatible observations, while the second set was only partially usable because of the lack of documentation accompanying the file.

c. Model Estimation and Analysis

Estimation and analysis of the models is the last of the three tasks.[1/] This task involved the application of the data

[1/] Ultimately, the use of the fully estimated and fine-tuned models should be undertaken as a fourth task, but the scope of the current project will not provide for, nor the available data permit, such an effort at this time.

acquired in the second task to the conceptual models constructed during the first task. Given the minimal adequacy of the data in most respects and the fact that the conceptual models were developed essentially from "scratch" rather than being modifications of earlier models, the goal of this task was not to develop fully estimated and fine-tuned models to be used for forecasting purposes. Instead, the goal is to determine whether or not there is a basis for further work in order to generate such forecasting models, and what the probable payoff would be to such an effort.

In the cases of Non-Profit Theater, Opera, Symphony, and Ballet, the data were sufficient to estimate one or more specifications of each behavioral (structural) equation of the model. In the cases of For-Profit Theater and Museum, only selected specification of selected structural equations could be estimated. And, in the case of Modern Dance, the data were insufficient to attempt any model estimation. Throughout the estimation process Ordinary Least Squares was used, although the Cochrane-Orcutt technique was used whenever serial correlation was indicated by the Durbin-Watson statistic.[1/]

The use of Ordinary Least Squares instead of Two Stage Least Squares for estimating the coefficients of equation variables in these simultaneous equation systems was out of necessity, as a result of the limited data bases available. As a result, some of the coefficient estimates are subject to simultaneity bias. But, in those instances where the adjusted coefficient of multiple determination ($\bar{R}^2$) is close to unity, the estimated relationship is strong and Ordinary Least Squares is doing a "good" job in spite of the equation being part of a simultaneous system.[2/]

2. Trend Modelling

The development of fully estimated trend models also involved three distinct tasks: (a) the preparation of the necessary algorithm (computer software), (b) data base acquisition and

---

1/ In most instances, however, the degrees of freedom problem was so severe that the Durbin-Watson test was unreliable.

2/ For an elaboration of this point, see Rao, P. and Miller, L.M., Applied Econometrics, Wadsworth Publishing Co.: Belmont, Calif., 1971, p. 195.

preparation, and (c) model estimation and analysis. Each of these tasks will be briefly described below.

a. Preparation of the Algorithm

The trending technique used in this study is that developed by G.E.P. Box and G.M. Jenkins, where each value for a variable is related to previous values and disturbance terms. This method of analysis is less demanding in terms of data requirements than an econometric model, because the only data needed are the observations for the phenomenon of interest, and not observations on a series of "causal" variables. It is precisely this economy of data which promised to make the technique useful for forecasting, but, at the same time, it is this economy of data which restricts the usefulness of the technique to short-term forecasting, by not considering the influence of other conditions substantially different from the present or historically observable.

In spite of the data economy incurred with the use of this technique, the mathematical manipulations necessary for estimation are formidable. As described earlier, a number of steps must be undertaken before reliable projection can be generated and many of these steps require a considerable degree of subjective judgment. Therefore, although a number of computer software packages are available for the user, a large part of the process remains subjective. For this study, the software package prepared by the Academic Computing Center, The University of Wisconsin - Madison, was used. Some minor modifications had to be made to the package to make it compatible with our hardware, but the program as supplied was essentially that ultimately used.

b. Data Base Acquisition and Preparation

The preparation of the data bases to be used for trend modelling coincided with the effort to construct the time series data for behavioral modelling. That is, this effort was conducted simultaneously with, and is indistinguishable from, the preparation of the time series for the key endogeneous variables in the behavioral modelling effort above.

c. Model Estimation and Analysis

Having made the software compatible with the hardware and having developed time series for key variables of each of the several art forms, the Box-Jenkins algorithm was applied to each time series. This application is not entirely automatic. Just as informed judgment had to be used in the behavioral modelling estimation process, the same level of judgment had to be employed in the trend model estimation. Choices had to be made among alternative models on the basis of length of lags, composition of moving averages, and whether to model first differences, variations from the series mean, or the absolute value of the observations. While some rules are provided for these judgments, the final decision is not "cut-and-dried."

C. Selected Research Findings

There is a wide range of useful findings resulting from this study. The findings range from implications as to data acquisition activities, to conclusions as to modelling approaches, to specific tests of hypotheses. Selected key findings, representing the full range of results, will be presented in this subsection of the report. The full treatment of the existing data sets is found in Section IV, above.

1. Data

The empirical analysis utilized a total of six separate data sets:

- a data set for For-Profit Theater (Broadway) developed by Applied Management Sciences,
- data sets applicable to Non-Profit Theater, Opera, Symphony, Ballet, and Modern Dance provided by the Ford Foundation,
- an update Non-Profit Theater data set provided by Touche-Ross & Co. based on Ford Foundation data and Theater Communications Group records,
- data for Symphony provided by the Center for Policy Research based on the American Symphony Orchestra League records,
- Museum time series data acquired from individual museums and the Smithsonian Library through the joint efforts of Applied Management Sciences and the Center for Policy Research, and

- a cross-section data set for Museums supplied by the National Research Center for the Arts.

The most comprehensive and consistent data set was found to be that supplied by the Ford Foundation. This set, while not providing the entire set of variables in the conceptual models, nevertheless satisfied the requirements for preliminary model estimation for Non-Profit Theater, Opera, Symphony, and Ballet. Its main deficiencies were found to be in the limited 9-year span it covers and the inadequate representation for Modern Dance. The first deficiency precluded the use of simultaneous estimation techniques, whereas the second deficiency precluded the possibility of any meaningful analysis of Modern Dance at all. In any event, the Ford Foundation data were well organized, edited for consistency, and provided in usable form. Any attempt to systematically update this data base would prove to be extremely valuable.

The attempted partial update by Touche-Ross using the Theater Communications Group data proved to be inadequate in light of the initial incompatibility of the two data sets. Perhaps, if more time and resources had been provided Touche-Ross, the necessary editing could have been accomplished, but it is probably the case that only the Ford Foundation, or an organization working closely with the Ford Foundation, can successfully update this data set in a strictly comparable fashion.

An alternative to the updating of the Symphony data base can be found in the use of the American Symphony Orchestra League (ASOL) records. These records are rich in detail and numbers of symphonies. This was demonstrated by the small part of these data (both in terms of number of symphonies and variables) which was made available to Applied Management Sciences. Thus, an effort at the development of a data base for symphonies would be successful in terms of the time span and coverage if the ASOL records are fully utilized.

The data sets which will require the most effort to develop are those for For-Profit Theater and Museum. The data set acquired for For-Profit Theater suffers from a lack of adequate cost and capacity data. These two deficiencies precluded the full model estimation. Efforts to remedy these deficiencies, while demanding

in terms of resources, are, nevertheless, feasible as was demonstrated by T. Moore's analysis of the cost data for selected years. The deficiencies in the capacity data can also be remedied through the analysis of theater records.

The Museum time series data proved to be inadequate for econometric model estimtation. This was due to the lack of standardization in the financial statements both among museums and over time for individual museums. That is, among museums the definitions of accounting items vary, the allocations of costs and revenues vary, and different levels of aggregation (i.e., different levels of detail) are provided. At the same time, individual museums were found to vary their accounting system and conventions over time. In addition, significant data items, i.e., attendance, were missing from the records of most museums. An effort to remedy the deficiencies in this data set is likely to be extensive (comparable to the Ford Foundation effort), but absolutely necessary if meaningful analyses of the several types of museums are to be undertaken.

The Museum cross-sectional data were used in the estimation of most of the conceptual model. However, the purely cross-sectional nature of the data required the modification of the model to eliminate the need for past information, i.e., lagged values for the variables and most first differences. This deficiency is a major handicap in the analysis of art organizations. It also exacerbates the heterogeneous nature of the museum industry. That is, the use of cross-sectional data introduces variances in the quantities being measured due to the substantial variation in museum types, sizes, operating characteristics, goals, ownerships, etc., and, to properly measure the impact of a particular phenomenon, all of these influences must be accounted for. This problem is substantially reduced when using time series data for the same sample of organization, because the between-year variation in the aggregate variables is standardized for the mix of museum types automatically (i.e., the mix of museum types is being held constant). The second deficiency for these data is due to the absence of information and criteria variables such as publications and educational programs. In sum, it is suggested that future Museum data acquisition activities be

aimed at a smaller sample over a period of time (to generate a time series). The records from such an effort would far outweigh a similar level of effort aimed at generating another large cross-section.

2. Behavioral vs. Trend Modelling

Although never addressed explicitly in the body of the study, one of the goals of pursuing two modelling approaches simultaneously was to draw comparisons regarding the relative merits of pursuing each. As a result, it is clear, even from the preliminary analyses the available data would permit, that most usable information is to be realized from the behavioral modelling and estimation. Of course, there are more approaches than just these two, but the comparative results are nevertheless instructive. Before the study was undertaken the expectation was that the trend modelling would be easier and quicker for non-econometricians to implement. However, given that the trend modelling approach being compared is the most sophisticated trending technique available, and given that the comparison is to be made against completely estimated and fine-tuned behavioral models, the earlier conventional wisdom is not so obvious.

The Box-Jenkins trend modelling was extremely difficult and complicated to implement. More importantly, however, a great deal of subjectivity was required in its application and these subjective judgments required the in-depth knowledge of a trained econometrician, statistican, etc. Further the level of expertise required was not reduced as more trend projections were made. Each projection was essentially an independent event that required the same degree of expertise as all earlier projections.

On the other hand, once a behavioral model has been estimated and fine-tuned, its implementation can become almost mechanical with the proper computer software.[1/] The most difficult step of the implementation would be the generation of exogeneous variable forecasts, but these need not be statistically obtained and any lack of sophistication can be compensated for by increasing the number of

1/ Some periodic updating (re-estimation) will be required, but this can periodically be contracted out to those with the necessary skills.

conditional forecasts conducted. The use of a forecasting model with the proper software does not require specialized knowledge beyond that concerned directly with the several arts industries.

Of course, completely estimated, fine-tuned behavioral models have not yet been produced. But, continued efforts at Box-Jenkins trend modelling will not escape the shortcomings listed above, while the results obtained thus far during the behavioral modelling effort are very promising. Surprisingly good results have been obtained with very inadequate data, and expectations are that, once the appropriate data have been generated, fully estimated and fine-tuned models will follow shortly.

Certainly, other trending techniques can and should be employed for short-run forecasting, but only the behavioral modelling approach seems viable for long-run forecasting and the results so far promise that such models, can be constructed without an inordinate expenditure of resources. Since all efforts compete for the same Arts Endowment resources, it is suggested that the behavioral modelling approach will produce a better, more useful long-run forecasting product that, in the long run, will be substantially more cost-effective.

3. Findings from Behavioral Modelling

There are a number of aspects of applying econometric models to the performing and visual arts industry that were explored in this study. These aspects ranged from the necessity to apply specific models, as opposed to a general model, to the several art forms; to an examination of where econometric modelling worked best (and why); to specific empirical findings with regard to the behavior of each of the several art forms. The most important of these findings will be described below.

a. General vs. Specific Models

In the case of all non-profit arts and cultural organizations excluding Museums (and, as it turned out, Modern Dance), an opportunity was provided to test the performance of a general or combined model against those of individual models for each organizational type. All of these organizations have basically

the same structure and all are assumed to operate under the same objective function. Therefore, the combining of the art forms into a single model was feasible. In addition, the Ford Foundation data base provided as much uniformity of data as possible among the several art forms.[1/]

While some interesting and useful results were obtained from the use of a general or combined model, it was quite clear that the individual models generated superior results. The basis for this conclusion are the observed differences in the signs and statistical significance of some of the coefficients in the general and specific models. This indicates that there are sufficient differences in the modes of operation among these non-profit art organizations to warrant individual treatment (estimation). As examples of these differences, the role of endowments for Opera and Symphony is different from that for Non-Profit Theater and Ballet; Symphony and Opera were further differentiated by the impact of the Ford Foundation Symphony Program; variations in the methods of establishing prices were observed; the roles of private and governmental contributions were different among the art forms; attendance determinants varied; advertising and promotional activities differed; etc.

In addition, a general model would lead to the dominance of the art forms with the greatest representation in numbers and/or budget sizes in the aggregate data base, which in this case would be the symphonies. Such a dominance obscures the relationships for an art form such as the Ballet which is represented by a small number of organizations: nine ballet companies versus seventy-six symphony orchestras.

b. Relative Behavioral Model Performances

It is quite obvious from the results presented in Section VI that the modelling and estimation effort for Symphony

[1/] In fact, despite the extremely good and thorough job of data editing by the Ford Foundation, there is some indication that the raw data received by the Ford Foundation varied substantially in quality among the art forms, so that complete comparability could not be guaranteed by this editing process.

was superior to the other efforts. Close examination reveals, however, that this superiority is not necessarily due to any intrinsic characteristics of symphonies, but rather is a function of the superior data base available.[1/] As an indication of this, it should be revealed that symphonies had, by far, the largest number of organizations represented in the Ford Foundation data base (i.e., 76 symphonies and orchestras). In addition, symphonies are one of the oldest and most well-established art forms and consequently have generated the most extensive and consistent data over the years. The Ford Foundation states that "Symphony orchestras have, after all, earlier historical roots in the United States than any of the other four performing arts covered in this study (Non-Profit Theater, Opera, Ballet, and Dance)" (The Finance of the Performing Arts, Volume I, p. 24); and Baumol and Bowen conclude that symphony orchestras are the sector of the performing arts for which there exists the fullest and most reliable information (see p. 60).

The point is that, while substantial improvements can be made in all future model estimation efforts (provided the data were available), significant improvements can be made only if the data of other art forms establish a level of consistency already reached by symphonies. It is encouraging to note that some efforts are presently underway in this direction as exemplified by the current efforts to standardize the accounting conventions of Museums.

c. Selected Empirical Findings

While the results of the project effort fall short of fully estimated simulation models (as expected), selected individual results throughout the several models present patterns which provide insight into the behavior of the arts and cultural institutions. There are six sets of general findings which require summarization. These findings deal with: (1) grants and contributions, (2) attendance, (3) pricing, (4) subscription sales, (5) worker productivity, and (6) the impact of general economic condition on the income gap. Each will be discussed in turn.

[1/] This superiority refers to within the Ford Foundation data base.

(1) Grants and Contributions

Grants and contributions and their causal factors as estimated among the several models are presented in summary form in Table 36. This table includes Federal grants, regional grants, private contributions, and foundation grants.

The level of annual appropriations for the Arts Endowment was positively related to the level of Federal grants received by each individual art form. At the same time, these grants were generally positively related to measures of the level of activity (i.e., either number of performances or attendance). In the cases of Non-Profit Theater and Symphony, the level of Federal grants received is negatively related to measures of overall economic activity, so that the Federal grants to these art forms increase whenever the economy (and presumably, the art organization also) is in a financial slump and other forms of grants and contributions are declining. Thus, similar factors influence the level of Federal grants for each art form. The Federal government tends to help those organizations in financial difficulty, and the size of these grants are generally commensurate with the amount of activity in the art form.

On the other hand, regional grants (State, county, and municipal) are influenced by a variety of factors among the art forms. This should not be surprising, however, in view of the variety of decision-making bodies which are involved in the allocation of these grants, and the specialization ot these grants in art forms which are regionally identifiable (e.g., Symphony, Ballet, and Opera). The estimated coefficients indicate positive relationships between regional grants and last year's Arts Endowment appropriations for only Opera and negative relationships for Ballet, Symphony, and Non-Profit Theater. The positive relationship is statistically significant, while the negative relationships are not. These mixed results indicate that Federal grants act as an incentive for increasing regional grants for one art form, but are viewed as a substitute in the others.[1/]

1/ While a large part of total regional grants represent fixed proportions of total National Endowment for the Arts appropriations, the relationship between the National Endowment for the Arts appropriations and the shares of regional grants going to individual art forms is not necessarily proportional.

TABLE 36: FACTORS EFFECTING GOVERNMENTAL AND PRIVATE GRANTS AND CONTRIBUTIONS FOR NON-PROFIT ART ORGANIZATIONS EXCLUDING MUSEUMS[1/]

	Art Forms \ Sources of Grants & Contributions	Federal Government	Regional Government	Private Groups & Individuals	Foundations
POSITIVE EFFECTS	All Art Forms Combined	1)NEA Appropriations*	1)Lagged NEA Appropriations*	1)Tax Rate* 2)Standard & Poor's Index	1)Deficit-Surplus Fund* 2)Number of Performances* 3)Ford Foundation Symphony Program*
	Non-Profit Theater	1)Number of Performances 2)NEA Appropriations	1)Number of Performances	1)Fund Raising Expenditures 2)Tax Rate* 3)Standard & Poor's Index	1)Capacity Expansion Factor 2)Deficit-Surplus Fund*
	Opera	1)Number of Performances 2)NEA Appropriations*	1)Lagged NEA Appropriations*	1)Fund Raising Expenditures 2)Tax Rate	1)Deficit-Surplus Fund 2)Number of Performances*
	Symphony	1)NEA Appropriations*	1)Lagged Regional* Grants 2)Attendance*	1)Attendance 2)Tax Rate* 3)Standard & Poor's Index	1)Number of Performances 2)Ford Foundation Symphony Program* 3)Change in Capacity
	Ballet	1)Number of Performances 2)NEA Appropriations	1)Gross National Product*	1)Tax Rate* 2)Standard & Poor's Index* 3)Lagged Fund Raising Expenditures	1)Deficit-Surplus Fund
NEGATIVE EFFECTS	All Art Forms	1)Number of Performances	1)Number of Performances 2)Gross National Product	1)Fund Raising Expenditures	1)Capacity Expansion Factor*
	Non-Profit Theater	1)Gross National Product	1)Lagged NEA Appropriations 2)Percentage Change in Gross National Product 3)Lagged Regional Grants	1)Attendance	
	Opera		1)Number of Performances	1)Attendance 2)Standard & Poor's Index	1)Attendance 2)Capacity Expansion Factor
	Symphony	1)Percentage Change in Gross National Product 2)Attendance	1)Lagged NEA Appropriations	1)Lagged Fund Raising Expenditures	1)Deficit-Surplus Fund
	Ballet		1)Lagged NEA Appropriations 2)Lagged Regional Grants* 3)Attendance		1)Capacity Expansion Factors 2)Number of Performances

[1/] It is important to keep in mind that the value of the Deficit-Surplus fund is usually negative so that a negative coefficient means a positive effect, and vice versa. An asterisk "*" indicates the statistically significant variables at the 95 percent level of confidence.

Last period's regional grants indicate negative effects on this period's regional grants for Non-Profit Theater and Ballet, whereas positive impacts are observed for Symphony. This means that for the former the level of regional grants tends to decline, ceteris paribus, while for the latter, the grants tend to increase.

The coefficient for the gross national product is positive in the case of Ballet while the coefficient for the percentage change in gross national product is negative for Non-Profit Theater. The expectation was that increases in the gross national product should lead to increases in regional grants as the incomes of the regional governments rise. Such expectations are still justified in view of the fact that only the positive impact is statistically significant.

Finally, extremely mixed results are obtained for variables measuring the level of operation: the number of performances and total attendance. The impacts are positive for Symphony and Non-Profit Theater and negative for Ballet and Opera, although only the positive impact for Symphony is statistically significant. The positive impact is undoubtedly a result of the ability of large (and successful) organizations to lobby for public support and to participate in fund matching programs. In general, it is likely that the behavior of regional grants to these stimuli relies heavily on the type of art organization being considered.

Private contributions combine the elements of philanthropy and investment behavior. The philanthropic behavior is based on the interdependence of the utilities of the contributor and the recipients of the assistance, whereas the investment behavior of the contributor is the result of his desire to assure the organization's continued existence so that he may continue to consume its product. The empirical analysis indicated a consistent and positive relationship between the average personal tax rate and the level of contributions. The estimated coefficients for Non-Profit Theater, Symphony, and Ballet were all statistically significant at the 95 percent confidence level. The analysis also indicated that private

contributions for these three art forms are elastic[1/] (evaluated at the means of the variables) with respect to changes in the average personal tax rate.

This finding is not contradictory to that of R.A. Schwartz[2/] where contributions were found to be inelastic with respect to changes in the marginal tax rate. A given percentage change in an average tax rate is the result of a much larger percentage change in the marginal tax rate. Thus, the responsiveness of contributions to a given change in the average tax will be much higher than the responsiveness of contributions to the same percentage change in the marginal tax rate.

In every instance but one, the measure of wealth (Standard & Poor's common stock price index) was positive indicating that contributions are related to the wealth positions of the contributors. The elasticities in these cases are very low, however, (inelastic) which confirms Schwartz's findings. Finally, the findings for both attendance and the level of fund raising expenditures are mixed. The coefficient for attendance is positive only in the case of Symphony, and none of these coefficients is statistically significant. At the same time, Symphony was the only art form for which the fund raising coefficient was negative, but none of these coefficients was statistically significant. Expectations were, of course, that attendance would have either a negative or a positive impact on contributions while fund raising should have a positive impact.

In summary, then, private contributions respond positively to increases in the tax rate, as well as (but to a lesser extent) to increases in the wealth positions of the potential contributors. Both attendance and fund raising activities produce mixed and insignificant impacts on private contributions so that further work is required before a final answer can be given for these effects.

Finally, the contributions of foundations and their causal factors are summarized in Table 36. These results

---

[1/] Elasticity is defined as the percentage change in the dependent variable (contributions) in response to a one percent change in the independent variable (tax rate). If the response of the dependent variable is greater than one percent, then the relationship is elastic, if not, then the relationship is inelastic.

[2/] Schwartz, R.A., "Personal Philanthropic Contributions," Journal of Political Economy, pp. 1278 and 1281.

indicate that, except in the case of Symphony, an increase in foundation grants accompanies an increase in the accumulated operating deficit. This supports the statement by Baumol and Bowen that "foundations have played a crucial role for a number of particular performing organizations. Indeed, without foundation support some groups would not have survived." (pp. 340,342). The case of the Symphony should be viewed in light of the very large Ford Foundation Symphony Program, which undoubtedly confounded the observed relationships between symphonies and foundations grants during the period studied.

The effect of the number of performances on foundation contributions is positive in all art forms, except for Ballet, but significantly so only for Opera. The positive relationships are likely to be the result of fund matching policies by foundations. Thus, the more successful an organization is, as indicated by its level of operations, the more likely it is to participate in programs which require matching funds from other sources. In addition, the interest of foundations in initiating new programs can best be accomplished by a successful organization. The negative relationship in the case of Ballet might be indicative of foundation support to help financially troubled organizations of this art form.

Lastly, the capacity expansion factor (the desire of the art form to increase its seating capacity) is very mixed, although never significant. It is likely that foundation support is not typically provided for capital expansion projects, but rather to aid financially troubled organizations or to encourage special programs.

(2) Attendance

Two types of attendance measures were attempted for most of the art forms: number of attendants and the utilization rate of the seating capacity. In almost all cases, the specifications using total attendance performed better than those using the utilization rate. These specifications had higher predictive powers, more significant coefficients, and more coefficients of the expected

signs. In particular, the coefficients on price were consistently negative, while the coefficients on consumer income were consistently positive. This, of course, is in accordance with economic theory which says that as average population incomes increase, the purchase of goods and services, including attendance at the range of art and cultural organizations, increases, and, as the price of a good (ticket price) increases, the amount demanded will decrease.

For most art forms, the crime rate in the area had a negative effect on attendance, as expected. At the same time, however, a variety of impacts of the unemployment rate on attendance was observed. For For-Profit Theater the effect was positive indicating that unemployment provides additional leisure time, at lower cost, which creates some additional demand for leisure activities, and generally restricts such leisure activity to the local area. On the other hand, the coefficient on unemployment for Non-Profit Theater is negative. Since the effect of income has already been accounted for by the income variable, a negative coefficient is not easy to explain, unless unemployment makes the population more sensitive to declines in income when contemplating Non-Profit Theater attendance.

(3) Pricing

The analysis suggests quite clearly that the pricing mechanism for the non-profit art organization is that of cost-plus-markup. The net cost of production is always a major determinant of the price of admission. At the same time, the size of the deficit-surplus fund usually influences the level of prices. That is, as the deficit grows, the pressure to increase prices also grows. Finally, the rigidity of the price structure and the reluctance to raise prices (this may restrict the audience base) is indicated by a negative coefficient on last period's price level. Thus, in the absence of any other changes or influences, the desired price has a tendency to decline from one period to the next. This is a reflection of the goal of maximizing attendance and maintaining a broad base of interest.

(4) Subscription Sales

The level of subscription sales was generally found to be positively related to the single ticket price of admission.

This was expected and because of the discount generally provided from the single ticket price to subscription holders. As a result of a general rise in the prices of admission among the various art forms (i.e., in all art forms except Opera), a general shift to subscription sales has been taking place. This relationship would not be expected to hold over the complete range of prices, since at some point the negative effect of the price increase on total sales will dominate the positive effect of the discount on subscription sales. What positive impact has been estimated, however, is understated because the percentage discount declined throughout the period investigated.

(5) Worker Productivity

Worker productivity was investigated by examining the behavior of the wage index in several cost functions (i.e., all but Museums). In every case, the coefficient on the wage index was positive, indicating that the cost function shifts upward as this wage index increases. If this wage index represents the change in money wages (and real wages) of the employees of the individual art organizations, then the upward shifting of the cost functions confirms the hypothesis that productivity of the worker is not keeping pace with money wage increases (i.e., real wages of the workers are increasing over time, hence the upward shift in the cost functions). This means, of course, that the real costs of production are increasing which will ultimately lead to labor saving production techniques (e.g., shifting towards non-musical drama and away from musicals, increased incidence of one-man shows).

(6) The Impact of General Economic Conditions on the Income Gap

Only four of the models--Non-Profit Theater, Opera, Symphony, and Ballet--were estimated from sufficient data to explore the impact of general economic condition on the size of the income gap (i.e., expenditures minus revenues). General economic conditions are represented by coordinations of eleven separate variables. Each of these variables and its association with, or influence on, the income gap for each of the four art forms is displayed on Table 37.

TABLE 37: IMPACT OF ECONOMIC AND POLICY VARIABLES ON THE INCOME GAP FOR SELECTED ART FORMS[1/]

Art Form \ Economic or Policy Variables	Compensations Per Hour in the Private Non-Farm Sector (CMPHR)	Per Capita Disposable Income (YD)	Average Tax Rate (t)	Annual Appropriations by the NEA (BNEA)	Previous Year's NEA Appropriations (BNEA-1)	Standard & Poor's Common Stock Price Index (SPI)	Unemployment Rate (Um)	Violent Crime Rate for the U.S. (Crm)	Price Index for Reading and Recreation, Substitutes (PS)	Price Index for Transportation Services, Complements (PC1)
Non-Profit Theater	+	-	-	-	+	-	+	+	-	
Opera	+	-	-	-	-	+			-	+
Symphony	+	-	-	-	+	-				
Ballet	+	-	-	-	+	-				

[1/] Income gap is defined as total expenditures minus total revenue

Most of the variables listed on Table 37 influence the income gap mainly through the revenue side. The hourly compensation in the private non-form sector (a proxy for money and real wages of employees of the four art forms) (CHMPHR) is positively associated with the income gap in each instance by leading directly to increased costs of production (expenditures). Indirectly, of course, increases in this wage index will lead to a reduction in revenues via a reduction in the equilibrium output level.

Those economic indicators operating on the income gap primarily through the revenue side, do so through either earned income or grants and contributions. A good example of the former is an increase in per capita disposable income (YD) which consistently reduces the income gap by increasing attendance and, therefore, earned income; whereas a good example of the latter is an increase in the average personal tax rate (t) which also consistently reduces the income gap, but through an increase in contributions. The only other general economic or policy variable which consistently impacts on the income gaps of all four art forms is this year's appropriations, (BNEA). The higher this year's appropriations, the lower the income gap. This is because of the direct effect that the Arts Endowment has on Federal grants.

Counterbalancing this positive effect of the Arts Endowment appropriations, however, is the positive impact of last period's appropriations on the income gap for all art forms except Opera. This year's regional grants awarded to three of the art forms are reduced as a result of large Arts Endowment appropriation in the previous year ($BNEA_{-1}$). This, of course, is because regional grants are viewed as substitute for Federal grants for art forms other than Opera.

The income gap for Opera is influenced differently than for the other three with respect to the Standard & Poor's Common Stock Price Index (SPI). Most art forms face a reduction in the income gap as stock prices increase through increases in contributions. That is, as the wealth positions of potential contributors increase, the size and likelihood of contributions also increase. The suggested

positive impact on the income gap for Opera is not based on statistically significant findings, however, and therefore is more suggestive of no impact at all for this art form.

None of the remaining economic or policy variables have suggested income gap impacts for all four art forms. For example, both the unemployment rate (Um) and the violent crime rate (Crm) are seen to influence the income gap only of Non-Profit Theater. In both instances, the impact on the income gap is positive. Both are deterants to attendance and indications of revenue losses.

For both Non-Profit Theater and Opera the income gap is seen to decrease as the price of substitutes (i.e., reading and recreation) (PS) increase, because the relative price of attending these art forms declines as a result. At the same time, the income gap for Opera increases as the price of complements (i.e., transportation) (PC1) increases, because the total price or cost of attending thereby increases.

Most of the models also included measures of the Gross National Product (GNP) and changes in the Gross National Product (PDGNP) which were generally found to negatively influence some types of grants. This would give the misleading impression that, as the economy prospers, the income gap of the arts and cultural organizations would increase. Certainly, some positive influence would be present through grants, but the overall influence on the income gap would also have to consider the negative impacts of personal disposable income and stock prices (as well as others) in order to fully ascertain the net impact. Unfortunately, the models are not sufficiently precise at this time to deduce the combined impacts with certainty. It can be said with a high probability, however, that the impact on the income gap of increasing Gross National Product is negative for all art forms. For this reason, the direct impacts of both variables are not presented on Table 37.

D. Recommendations

This project has accomplished each of its three main goals. Full-scale conceptual models were constructed for each of seven

separate art forms, all known data were acquired and put in machine-readable form, and these data were applied to each of the conceptual models. In view of the state of available data, the estimation of the models can be regarded only as preliminary to further data acquisition and full model estimation. It is only after such data become available that models can be sufficiently estimated to be used for forecasting purposes. In the process of accomplishing the several goals of the project, several conclusions can be drawn relative to the direction that future efforts should take, if any are to be taken at all.

Clearly, the preliminary efforts at model estimation were fruitful in terms of describing accurately a large part of the behavior of the various organizational types. Further, this work was very enccuraging, in that it held out the promise that full-scale estimation, resulting in fine-tuned forecasting models, could be completed successfully provided that adequate data were made available. The results using the American Symphony Orchestra League data support this conclusion. Even though the data elements were sparse and the editing primitive relative to the Ford Foundation data, the fact that the time series covered was much longer produced superior results for Symphony compared to those obtained from using the Ford Foundation data. Thus, it is expected that increases in both the number of time series observations and the number of variables included in the data set (i.e., the development of data bases which conform to the specification of the conceptual models and which provide enough observations to produce statistically meaningful results) will, with a high probability of success, produce econometric models which are suitable for simulation and forecasting.

The specific steps to be undertaken relative to the creation of adequate data bases have already been covered in detail in Section IV. In summary, the acquisition of data for each of the art forms is possible, although with varying levels of required effort. The most fruitful approach would be to complete the editing (in the tradition of the Ford Foundation) of the extensive data set already acquired by the American Symphony Orchestra League.

This is an outstanding data base, but it requires substantial editing to make the observations compatible.

The second most fruitful approach is to extend the Ford Foundation study on all or a subset of the organizations included. A few more years of these data (properly edited by the Ford Foundation) would greatly enhance the model estimation effort. Of course, the linking of other data sets with the Ford Foundation data base should also be explored, but the effort to link the Theater Communications Group data was not very successful. Many variables were excluded and many others appear to be incompatible. Whether extensive editing would be sufficient to permit such linking is unknown to Applied Management Sciences in the absence of first-hand knowledge.

Considerable work should be done to generate additional For-Profit Theater data and must be done to generate sufficient data on Museums. With a minimum of effort one could substantially improve the For-Profit Theater data by extending the effort of Dr. Moore, investigating the availability of seating capacity data, by acquiring wage structure data for Broadway artists, and by exploring such data deficiencies as attendance, secondary sources of income, and production by company. An attempt was made to construct a time series for Museums, but the editing required proved to be beyond the resources allocated to the project study. It is felt, however, that the core of an adequate Museum data base can be developed through such an effort, and it is sure to be more cost-effective than duplicating the cross-sectional approach of Museums U.S.A. Such data may be useful to other researchers for other programs, but they are of limited usefulness in generating forecasting models. Accordingly, it is felt that resources should be allocated to other tasks in the future.

Lastly, implicit in the above recommendations is the abandonment of the Box-Jenkins trend modelling approach. Even though the above data recommendations apply equally as well to this approach as to behavioral modelling and even though Box-Jenkins trend modelling will produce forecasts superior to those of other trending techniques, the complexity of implementation and the

expert judgment required therein obviates the primary purpose for its use. It will not prove to be an effective "short-cut" method for generating short-term forecasts compared to simulation models. As a matter of fact, once an econometric model has been fine-tuned,[1] the generation of both short- and long-term forecasts can be converted to a series of purely mechanical tasks that can easily be undertaken by one unskilled in econometric techniques when computer facilities are available.

With these points in mind, Applied Management Sciences is enthusiastic about the potential for success in developing fully estimated econometric models once the appropriate data have been acquired. Certainly, there has been nothing to this point in the analytical effort to indicate that such an effort would not be successful. To the contrary, the empirical results have repeatedly confirmed expectations based both on economic theory and the conversations with the expert consultants. The models as conceptualized are essentially correct and only await the necessary data to realize their full potential.

[1] Of course, this will require some additional allocation of resources to data generation and model estimation activities.

BIBLIOGRAPHY

American Symphony Orchestra League. Survey of Arts Councils Edited by L.C. White & H.M. Thompson, 1959.

Association of College, University and Community Arts Administrators, Inc. Profile Surveys I-VI (1965-1975). Wisconsin: Association of College, University, and Community Arts Administrators, Inc., 1975.

Baumol, William, and Bowen, William. Performing Arts - The Economic Dilemma, Cambridge: The M.I.T. Press, 1966.

Benedict, S. Economic Survey of the Arts. Council or Foundations, Inc. New York, 1976.

Birkenhead, Thomas B., "Economics of the Broadway Theater." Unpublished Ph.D. dissertation, New School for Social Research, 1963.

_____. "Tickets, Attendance and Capacity of the Theater Industry," Theater Design and Technology. 4 (Feb. 1966), 12-19.

Bernheim, Alfred L., and Harding, Sara. The Business of the Theatre: An Economic History of the American Theatre, 1750-1932. New York: Benjamin Blom, 1964.

Blackburn, Richard S. "College and University Financial Support of the Professional Touring Performing Arts." Unpublished Master's Thesis, University of Wisconsin, 1974.

Bladen, V. "The Economics of the Performing Arts," Canadian Perspectives in Economics, Toronto: Collier-MacMillan Canada, Ltd., 1972.

Council of Economic Advisors. Economic Report of the President. Washington, D.C.: Government Printing Office, 1976.

Dickinson, Frank G. The Changing Position of Philanthropy in the American Economy, New York: National Bureau of Economic Research, 1970.

"Economics and the Non-Commercial Theater." Educational Theatre Journal, XVIII (Nov., 1966), 352-56.

Faine, Hyman R. "Unions and the Arts," American Economic Review, LXI (May 1972).

Ford Foundation. The Finances of the Performing Arts. New York: The Ford Foundation, 1974. Vol. I & II.

Globerman, S., and Book, S.H. "Statistical Cost Functions for Performing Arts Organizations," Southern Economic Journal, 40 (April 1974).

Hart, Philip. Orpheus in the New World: The Symphony Orchestra as an American Cultural Institution. New York: W.W. Norton and Company, 1973.

Haworth, C.T., and Rasmussen, D.W. "Determinants of Metropolitan Costs of Living Variations." Southern Economic Journal, 40 (October 1973).

Hilton, A. "The Economics of the Theatre." Lloyds Bank Review, 101, (July 1971).

Heckscher, A. The Arts and the National Government, Report to the President, May 28, 1963.

League of Resident Theatres (LORT). Annual Survey 1965-1975.

Martin, Elsie M. "A Study of Financial Support to the Performing Arts." Master's Expository Paper, University of North Caroline, July 1975.

Mathematica, Mathtech Division. "The Effect of Theatre on the Economy of New York City." Prepared for the First American Congress of Theatre (FACT). New Jersey, April 14, 1976.

Moon, R. The 1975-76 Concert Season: A Prediction ACUCAA, 1975.

Moore, Thomas. The Economics of the American Theater. Durham: Duke University Press, 1968.

Moskow, M.H. "Trade Unions in the Performing Arts." Monthly Labor Review, 93 (March 1970).

National Committee for Cultural Resources. National Report on the Arts. NCCR, 1975.

National Endowment for the Arts. Dance. Washington, D.C.: National Endowment for the Arts, 1970.

National Endowment for the Arts. Economic Aspects of the Performing Arts. Washington, D.C.: National Endowment for the Arts, 1976.

National Endowment for the Arts. Employment and Unemployment of Artists. Washington, D.C.: National Endowment for the Arts, 1970.

National Endowment for the Arts. Guide to Programs. Washington, D.C.: National Endowment for the Arts, 1975-1976.

National Endowment for the Arts. Opera. Washington, D.C.: National Endowment for the Arts, 1970.

National Research Center of the Arts. Study of State Arts Agencies: A Summary Report. New York: National Research Center for the Arts, 1972.

National Research Center of the Arts. A Study of the Non-Profit Arts and Cultural Industry of New York State. New York: National Research Center of the Arts, 1976.

National Research Center of the Arts. Museums, USA: A Survey Report. Prepared for the National Endowment for the Arts, 1975.

Naylor, Thomas H., Seaks, T.G., and Wichern, D.W. "Box-Jenkins Methods: An Alternative to Econometric Models." International Statistical Review, Vol. 40, No. 2, 1972.

New York City Cultural Council and the New York State Council on the Arts. A Study of the New York Theater, New York: 1972.

Panasuk, Christine. An Analysis of Selected Performing Arts Occupations. Ottawa, Ontario: Canada Council Information Services, July 1974.

Peacock, A., and Godfrey, C. "The Economics of Museums and Galleries." Lloyds Bank Review. January 1974.

Pfeffer, I. "Fine Arts: A Problem in Risk Management," California Management Review. 15 (1972).

Poggi, Jack. Theater in America: The Impact of Economic Forces, 1870-1967. Ithaca, New York: Cornell University Press, 1968.

Rao, Potluri and Miller, R.L. Applied Econometrics, Belmont, California: Wadsworth Publishing Company, Inc., 1971.

Rockefeller Panel Report. The Performing Arts: Problems and Prospects. New York: McGraw Hill, 1965.

Rogers, L.E. Museums and Related Institutions: A Basic Program Survey. Washington, D.C.: U.S. Office of Education, 1969.

Schwartz, Robert A. "Corporate Philanthropic Contributions." Journal of Finance. 23 (June 1968).

_____. "Personal Philanthropic Contributions." Journal of Political Economy, 78 (November/December 1970).

_____. Private Philanthropic Contributions: An Economic Analysis, Unpublished Ph.D. dissertation, Columbia University, 1966.

Scott, M. The States and the Arts, Institute of Governmental Studies. University of California, Berkeley, 1971

Seaman, B.A. "The Pattern of Performing Arts Financing." Urban Economics Workshop, University of Chicago, June 1976.

Stoyle, Judith. Economic and Demographic Characteristics of Actors' Equity Association Membership. Philadelphia: Actors' Equity Association in cooperation with the Bureau of Economic and Business Research, School of Business Administration. Temple University, 1970.

Theater Communications Group. Annual Fiscal Survey (1974-75). New York: Theater Communications Group, 1975.

_____. Theatre Profiles: An Information Handbook of Non-Profit Professional Theatres in the United States. New York: Theater Communications Group, 1975.

Watts, John G. "Economics of the Broadway Legitimate Theatre. 1948-1958." Unpublished Ph.D. dissertation, Columbia University, 1969.

APPENDIX A

SUMMARIES OF PREVIOUS POLICY STUDIES

A. Baumol, William and Bowen, William, Performing Arts - The Economic Dilemma, The Twentieth Century Fund, New York, 1966

1. Summary

a. Intentions/purpose:

"The central purpose of this study is to explain the financial problems of the performing groups and to explore the implications of these problems for the future of the arts in the United States." (Page 5)

b. Model and Findings:

The authors present the following conclusions:

- The "cultural boom" while a reality is an exaggeration. Per capita proportion of disposable income spent on the arts has been almost constant for the period 1929-63.
- The typical audience at professional performances is not representative of the population as a whole. It is characterized by a higher than average education and income.

  "The most remarkable finding is that audiences from art form to art form are very similar. ... All exhibit an extremely high level of education ... and there is a consistently high level of income..." (Page 84).
- The forces that led to the current economic crisis in the performing arts are still in operation and are expected to increase their intensity.
- The authors emphasize the nature of the technology of the performing arts in analyzing the crisis. "... From an engineering point of view, live performance is technologically stagnant." (Page 164) The problem is the small productivity improvements that are possible in the service industries. Thus, as productivity increases per unit of labor are achieved in the other sectors, with the corresponding wage increases, the relative income of artists would decline. Obviously, the artists demand wage increases that would protect their relative income standing. The granting of any raises above the productivity increases, negligible in this case, leads to an increase in costs and a worsening of the crisis.

The other side of the issue is demand for the performing arts. The problem here is that the price of admission faces restrictions as far as changes are concerned:

.. art organizations are not inclined to raise their prices, "on moral grounds,"

.. the demand for art is elastic,

.. competition from the mass media.

2. Critique

a. Omissions:

The authors did not develop a general model or one for any of the subgroups. This would have aided in analyzing the forces that operate in the performing arts. The lack of any model stands out given the large amount of data collected for the study. There is, however, an attempt to study the cost function for orchestras and its resemblance to the U-shaped average cost curve.

b. Comments:

The study was a follow up on Thomas Gale Moore's, The Economics of The American Theater. It expanded the analysis to non-profit theater, orchestra, opera, dance, ... etc. The data draw on Moore's study, Variety magazine, Playbill Survey, The Best Plays, Twentieth Century Fund audience survey, ... etc.

List of Variables:

1) Number of companies and performances for opera 1941-42 - 1963-64.

2) Number of shows, average attendance and number of performances for Broadway, 1899 through 1969.

3) Number of productions of performances off-Broadway, 1953-54 - 1964-65.

4) Major orchestra data on the length of season, number of concerts, paid concerts and attendance, 1937-64.

5) A survey of audience characteristics.

6) Indices of top Broadway ticket prices including tax, 1927-1965.

7) Indices of major orchestra ticket prices, 1928-64.

8) Attendance for (11) major orchestras and the Metropolitan Opera, 1947-65.

9) Number of performances and length of run for Broadway, 1949-50 - 1963-64.

10) Individual philanthropic contributions, 1917-72, aggregates.

11) Individual and corporate philanthropy, 1917-1962.

Other data were presented, but the above were singled out as the more relevant data for our purposes.

B. Benedict, S. Economics Survey of the Arts, Council on Foundations, Inc. 4/10/75; 9/25/75; 7/16/76

1. Summary

a. Intention/Purpose

The goal of these studies was to identify longitudinal trends in performing arts organizations. This is difficult within the short time frame of the three surveys. (1972-76)

b. Models and Findings

There was no model presented as representative of the behavior of any organization. Findings were limited to very short-term descriptions of upward trends in expenses.

2. Critique

a. Omissions

Aside from the lack of an organized model, the sample used was entirely too limited. Only about 30 organizations were surveyed over the time span of the data. This study was closer to a cross-sectional investigation than to a time series.

List of Variables

- Sample: 5 commercial theaters, 4 ballet, 8 museums, 5 operas, 9 symphonies, 3 performing arts, assorted community arts centers, festivals.
- Time frame: 1972-1976
- Total expenses
- Earned income
- Unearned income

b. Comments

The gross aggregate earning and expenses figures relegate this study to being a purely descriptive one. No causative links may be identified from this data.

C. Globerman, S. & Book, S.H.
"Statistical Cost Functions for Performing Arts Organizations"
Southern Economic Journal, 4/74

1. Summary

a. Intention/Purpose

This paper addressed itself to two major goals:

- An attempt to identify cost-output relationships for performing arts groups
- Identification of any economies of scale present in the industry

These efforts were aimed at identifying manners in which performing arts organizations might minimize their deficit between production costs and earned revenues.

b. Model and Findings

1) The authors' hypothesis is that production costs are affected by five classes of variables:

- Quantity of service units
- Product mix and diversity
- Service quality
- Factor price levels
- Institutional preferences

2)
- When measuring service unit quantity for performing arts, it is obvious that increased numbers of performances will increase costs
- The authors state that higher variance in the type of performance (i.e. - increase repertoire, greater number of diversified talents required) will necessarily increase costs
- Higher quality levels required for diversified product mix will exhibit itself in higher input prices
- Factor prices are stated to be functions not only of quality, but of regional differences as well. The authors, noting the high mobility of artists, view factor price differences as quality differentials

- More established organizations need pay less attention to their long-run average cost curves. This reflects itself in higher production costs, greater product diversity and fewer economies of scale.

3) Variables used:

- Total costs (c)
- % of performances which are classified as "main" performances as a proxy for product mix (M)
- Audience size per performance as a proxy for quality (A)
- Length of season - (L) } proxies for
- Age of organization (Y) } institutional preference

4) Data sources:

- All data was obtained from mail-out surveys sent to 23 members of the Ontario Federation of Symphony Orchestras and from grant applications to the Canada Council

5) Statistical Techniques:

- Separate OLS estimates were run with this data on 33 symphonies and 27 theatre groups for 1971-72 with the following results:

for symphonies:

$$c = -76772.81 + \underset{(3.37)}{15171.18Q} - \underset{(-2.34)}{58.47Q^2} + \underset{(1.92)}{.61\,Q^3}$$

$$+\underset{(3.03)}{8683.13M} + \underset{(2.35)}{330.29A} + \underset{(2.84)}{85926.93\,L} + \underset{(1.47)}{7666.11Y}$$

$N = 33 \qquad R^2 = .730 \qquad F = 15.34$

for theatre groups:

$$c = -44923.54 + \underset{(2.55)}{35163.07Q} - \underset{(2.86)}{209.21Q^2} + \underset{(3.48)}{.403Q^3}$$

$$-\underset{(.89)}{85.66A} + \underset{(1.34)}{15753.05Y} + \underset{(2.18)}{49236.89D}$$

$N = 27 \qquad R^2 = .871 \qquad F = 25.86$

6) Findings:

- For symphonies, the authors find that lowest average cost occurs at about 115 performances. For theaters, the corresponding number was 210.

c. Conclusion

The authors contention is that funding should be used primarily to increase touring performances of established organizations rather than for funding of new groups. This allows for lower average cost per performance as well as decreasing the necessity for more diversified performing seasons.

2. Critique

- While the authors did address their initial statement of purpose in seeking some economy of scale in the performing arts market, there is serious question as to whether the specification of their model has brought them to this goal. There are several drawbacks:

1) The presence of a negative intercept in both equations indicates that this model is only a good approximation within a small range of the data. There is serious doubt as to whether this model can resemble the average cost function over any wide range

2) Single equation estimation in this case must bias the coefficient on the number of performances as there is evident multicollinearity among the exogenous variables

D. Hilton, Anthony, "The Economics of the Theatre," Lloyds Bank Review, No. 101, July 1971.

1. Summary

a. Intention or Purpose:

An examination into the causes of the financial problems of the theater industry. Examines issues such as productivity in the theater, audience composition, ticket pricing policy, salaries and wages, ownership, and government subsidies.

b. Model and Findings:

None

c. Conclusions:

- One of the major causes of the increasing financial problems of theaters (both profit and non-profit) is the lack of gains in labor productivity, since the number of actors required to perform a play does not change. Hilton makes the statement that "it is this change in cost relationships between services and manufacturing that is at the root of the theatre's problems."
- Another part of the problem, according to the author, is the changing composition of theater-goers. The audience for straight theater is comprised mostly of highly educated, high-income people. Despite the fact that the audience is getting more well-off, a corresponding increase in theater revenues has not been evidenced.
- Hilton points out the failure of theater owners to recognize the highly inelastic nature of the demand for plays. Although there is some price discrimmination in the form of higher ticket prices on weekends, Hilton argues that prices could be increased even more in instances of high demand for a particular production.
- Hilton argues that the present over-supply of actors in the field is unnecessary, and suggests that the number of new entrants into the profession should be reduced. "... compulsory registration of drama schools, the imposition of certain standards of tuition and a ban on the employment of non-graduates might provide a starting point."

- Finally, Hilton addresses the question of government subsidies to the theater industry. "The whole question of subsidy, whether or not it is desirable, depends in the end on value judgements of the type [of] ...welfare economics."

2. Critique:

The article is limited to a descriptive approach to the financial problems of the theater. The insights provided by the author were interesting and beneficial, but a more rigorous approach to the subject would have been more helpful.

E. Martin, Elsie Myers, A Study of Financial Support to the Performing Arts," Master's Expository Paper, Curriculum in Operation Research, University of North Carolina, Chapel Hill, July, 1975.

1. Summary

a. Intention or Purpose:

The author undertook "... a search for a,quantified relationship between the deficit and contributions, looking at a selected sample of art groups in 1969-70." (P.9) She makes the assumption that "... a deficit is the motivation for contributions." (P.9)

b. Model and Findings:

Contributions per capita (C1) were given as dependent on the accumulated per capita gap (GAP):

$$C1 = aGAP^b \qquad \ldots(1)$$

The author accounts for governmental (GOV) and foundation (FND) grants as follows:

$$C1 = aGAP^b e^{d(GOV)+f(FND)} \qquad \ldots(2)$$

This last equation was redefined so that those who receive (GOV) have:

$$C1 = aGAP^b e^{d(GOV)} \qquad \ldots(3)$$

and those who receive (FND) have:

$$C1 = aGAP^b e^{f(FND)} \qquad \ldots(4)$$

Finally, the author modified her model so that it is basically equation (1) but with an adjustment in the data. This adjustment is by accounting for (GOV), (FND) and the endowment income in (GAP). This gives us a variable (GAP4) which is the explanatory variable for (C1):

$$C1 = aGAP4^b$$

$0 < a < 1$ and $o < b \leq 1$

Theater:

When regressing (C1) on (GAP), (b) was found to be not significantly different from one. This suggests that "... contributions are increasing at the same rate as the accumulated gap..." (P.25) The equation states that about one-half of the gap is covered by contributions.

As grants and endowment income are accounted for, the value of (a) rises to approximately two-thirds. This suggests that contributions cover two-thirds of the gap. The value of (b) remained not significantly different from one.

Opera:

The values of (a and b) were smaller for the opera in comparison to the theater. But both were within the limits for the model.

Symphony:

The values of (a and b) were larger than the case for the opera, but when compared to the theater, the values for (a) were close, while (b) was smaller.

c. Conclusions:

The models estimated lead to the following conclusions:

- In the case of theaters "... the ratio of contributions to the deficit remains constant." (P.37)
- In the case of the opera "... a constant proportion relationship was not evident from the regression analysis... ." (P.37)
- The case for symphonies differs from the above two as "... no statistically acceptable equation was found for all symphony data. However, within a limited range of contributions, the results are acceptable." (P.38)

2. Critique

a. Omissions:

An analysis that relates the results of two types of behavior lacks the explanatory power of a model that deals with the structural relationships. We cannot understand the factors affecting contributions by merely studying the demand for them. It was necessary to study the cost of soliciting these contributions, the structure of the financing of the relevant institutions and the deficits incurred over time.

b. Critical Comments:

In addition to the omissions mentioned above, the author biased her study by her sample selection. She stated that "... companies which could support themselves without contributions were considered anomalous organizations and removed from the sample." (P.9) This is the case since even these companies receive some type of contributions and their deletion from the study overstates the role of the deficit in explaining contributions.

F. Moon, Robert

"The 1975-76 Concert Season: A Prediction" Association of College, University and Community Arts Administrators, Inc. Fall, 1975

1. Summary

a. Intention/Purpose

The goal of this study was to develop a series of predictions regarding the revenues, costs, quantities and makeup of arts performances in the 1975-76 season based upon past trends.

b. Model/Findings

1) No initial hypotheses were presented.

2) The reason given for this presentation was a growing concern for the future of certain art forms in the college, university and non-profit market.

3) The variables from the survey data are as follows:

- Number of performances
- Total fees for artists
- Total other direct costs
- Program types
  - .. Theater
  - .. Instrumental
  - .. Chamber music
  - .. Contemporary dance
  - .. Symphony
  - .. Opera and Choral
  - .. Jazz
  - .. Folk
  - .. Modern
  - .. Rock
  - .. Ballet
  - .. Ethnic Dance

- .. "Big Names"
- .. Vocal Recitals

- Institution Type
  - .. College and University
  - .. Nonprofit institution

- Region (9 groupings)

- Student Enrollment
  - .. less than 3000
  - .. 3000 - 4999
  - .. 5000 - 9999
  - .. 10,000 - 19,999
  - .. 20,000 plus

- Education Level
  - .. 2 year
  - .. 4 year
  - .. 4 year plus graduate

- Public vs. Private

- Sources of Budget
  - .. Tickets
  - .. Student fees
  - .. State agencies
  - .. NEA
  - .. Academic funds
  - .. Individual/Corporate Contributions
  - .. Membership
  - .. Community Government
  - .. Tuition Income

4) The source of all of these data is a series of six surveys of colleges and non-profit institutions dating from 1965. It is assumed at this point that the data are consistent in scope and definition across these surveys.

5) Other than simple tabulations, no statistical techniques of any importance were used.

6) The findings of this study consist of a series of projections, which are listed below.

- 195 institutions will present 3,515 performances that cost $12,015,119 in artist fees in 1975-76.
- Average fee/performance is $3418.
- 195 institutions will spend $4,014,923 in other costs or $1237/performance.
- Average total cost/performance is $4,655.
- 195 institutions will spend $16,030,042 in direct costs for 3515 performances.
- Average fees increased 37.8% from 1974-75 to 1975-76.
- Other costs increased 24% over the same period.
- Three year increase in total costs has been 66.7%.
- Vocal recitals are down 57%, symphonies down 33% from 1974-75 to 1975-76.
- Over the same period, theater up 34.8%, contemporary dance up 36.1%.
- In subscription sales, 40% report increase, 15% report decrease.

c. Conclusions

As a simple data collection procedure, there were no specific conclusions drawn.

2. Critique

As far as data collection is concerned, this study appears to have been reasonably successful, though it remains to be seen as to whether or not aggregated "other costs" is useful as a variable. It would have been preferable to have more information on the type of costs.

G. Moore, Thomas Gale, The Economics of the American Theater, Duke University Press, Durham, N.C. 1968

1. Summary

a. Intentions/Purpose:

"The purpose of the study... (is) to discover the present state of the American professional theater." (Preface) This knowledge will be used in making projections of the future state of the theater.

b. Model and Findings:

- "...no reason to believe that rates of profit have declined for investment in Broadway productions." (p. 21)
- A slight increase in Broadway attendance took place since the mid-thirties
- "A substantial increase in dramatic activity" has occurred off-Broadway since the war
- The quality of plays has improved over time
- Income elasticity of demand for the theater appears to be unitary
- "As per capita wealth continues to rise and is reflected in increased income, we can predict a proportional growth of attendance on Broadway, a smaller jump in the amount spent on complementary goods and services, and a still smaller rise in the price of tickets bought." (p. 91)
- Price elasticity seems to be less than unitary
- Ticket prices should be raised thus increasing revenue
- Rules that govern pricing should be repealed or modified so that the theater can adjust its prices to changes in the market.

c. Projections:

- An increase in the number of shows and attendance should take place following the removal of the 10% federal ticket tax
- The price of admission is not expected to show a long-run decline

- The growth in attendance for Broadway will continue to be slow due to the modest responsiveness of attendance to income changes, the increase in ticket prices and the increased cost of transportation
- As personal income increases, we would expect a rise in operating costs and ticket prices
- The road is in a state of decline
- Resident companies have increased their number since World War II, but the potential for further growth seems small
- Summer stock seems to be "the strongest branch of the theater outside New York."

2. Comments:

Moore's work is a thorough study of the American theater. He supports his analysis with data that is also valuable in constructing models of the theaters. He presents a model for attendance, shows and costs of production.

List of Variables

1. Total production, performances, productions still running at end of season, average number of performances during the season, Off-Broadway, 1953-54 - 64/65.
2. Average production costs for selected seasons
3. Average weekly operating income and expenses for selected seasons
4. Operating and production costs for selected seasons
5. Playing weeks, gross revenue and number of shows for the road and Broadway 1948-49 - 1965-66.
6. Subsidies for the arts for selected cities for operating expenditures for 1959.
7. Broadway productions for 1919/20 - 1964/65.
8. Number of shows playing during an average week for 1926/27 - 1965/66.
9. Estimated average February weekly attendance for 1926/27 - 1965/66

10. Box office receipts for 1924/25 - 1965/66

11. Top and average ticket prices 1926/27 - 1965/66.

12. Average run of shows opening during season for 1927/28 - 1961/62.

13. Total Broadway shows and performances playing during season for 1927/28 - 1963/64.

14. Theaters and performances per theater for 1928/29 - 1963/64.

15. Average total costs of major items for plays opening during selected seasons.

H. National Committee for Cultural Resources
National Report on the Arts
October, 1975

1. Summary

a. Intention/Purpose

This report stated three basic objectives: (1) To diagnose the present health - or lack of it - of arts organizations, (2) To determine regional differences, if any, and, (3) To seek facts which may form a basis for national policy of support for the arts.

b. Model and Findings

1) Hypotheses - The essential underpinning of this study is the contention that while interest in the arts and attendance at arts programs have increased dramatically over the past several years, the costs of these programs have risen even more dramatically, forcing these organizations into an "income gap."

2) The basic rationale for this hypothesis is the fact that, even in the face of increased interest in the arts, programs have had to be curtailed or cancelled due to rapidly rising costs. The reason stated for this situation is that the performing arts are, of necessity, labor intensive and cannot shift to more capital intensive production techniques in the face of higher labor costs.

3) Variables used in the survey include the following:

- Total expenditures for a performing arts institution for a year
- Total performances/year
- Number of employees
- Number of non-paid volunteers
- Level of earned income from ticket sales, subscriptions, etc.
- Income from private contributions
- Income from investment and corpus endowment income
- City, County, and State aid

- Federal grants and appropriations
- Number of programs considered but not implemented, number of operating programs, and number of programs dropped due to lack of funds.

4) All data were obtained from questionnaires from 433 non-profit arts and cultural institutions, which were differentiated by region of the country (North, South, East, West), type of art form (Visual arts, performing arts, other), and size (small, medium, large).

5) Statistical techniques were limited to simple tabulations across the above variables.

6) The evidence shows that, including programs which were desired but not undertaken, revenue fell short of costs by about 14% and this income deficit is growing over time.

c. Conclusions

This study reaches 3 basic conclusions:

1) The growth of funding for arts institutions, must come mainly from broad-based local support.

2) State aid should amount to no less than 10% of the required funds of arts organizations within the state.

3) Federal aid should amount to an additional 10% of funds required throughout the nation.

2. Critique

a. Omissions

Within the scope described for this study, there were no significant omissions. The study addressed all of the originally stated purposes.

b. Critical Comments

The attitude of this study toward the value of performing arts organizations and the demand for their services is understandably self-serving. The wording consistently used to describe the shortfall of revenues with respect to costs followed the same pattern:

"In order to meet the financial needs of arts organizations, (agencies) should provide ... funds needed by arts organizations."

This equation of the concept of "need" and the concept of "demand" is typical of analysis derived from a position of vested interest. From this standpoint, this study failed to provide evidence that the current number of arts and cultural programs were inadequate in the face of national demand.

I. National Endowment of the Arts, Opera. Washington, D.C.

1. Summary

a. Intentions/Purposes:

The compilation and analysis of data of a survey dealing with "...organizational and employment patterns, programming, attendance, and levels of income and expenditures for the nation's largest dance companies." (Preface)

b. Model and Findings:

No model is presented. The findings are limited to a presentation of the results of the survey.

c. Conclusions:

None.

. Critique

a. Omissions:

The study did not present a model for the analysis of the collected data.

b. Comments:

The study fulfilled its purpose of compiling data for various aspects of dance companies. It failed to analyze the collected data and limited itself to the reporting of aggregates. The failure is due to the lack of a general model which would help in presenting expectations as well as observations. This unfulfilled part of the study would have been valuable in dealing with policy questions.

List of Variables in the (Dance) Data

1. General data as to year of establishment, incorporation, ... etc.
2. Home performances: capacity of theater, price of tickets, ... etc.
3. Tour performances: audience composition, fees, ... etc.
4. Residencies: fees received for services, some cost items.
5. Type of production: new productions, revivals, ... etc.
6. Staff expenses.
7. Dancers: composition by sex, rehearsal time, salaries, ... etc.

8. School operations: activities related to dancing and whether they are or are not for profit.

9. Expenditures: salaries, travel expenses.

10. Sources of income: earned income, contributions and endowment income.

J. National Endowment for the Arts, Opera, Washington, D.C., June 1971

1. Summary

a. Intentions/Purposes:

The compilation and analysis of data of a survey dealing with "...organizational and employment patterns, programming, attendance, and levels of income and expenditures for the nation's opera companies." (Preface)

b. Model and Findings:

No model is presented. The findings are limited to a presentation of the results of the survey.

c. Conclusions:

None

2. Critique

a. Omissions:

The study did not present a model for the analysis of the collected data.

b. Comments:

The study fulfilled its purpose of compiling data for various aspects of opera companies. It failed to analyze the collected data and limited itself to the reporting of aggregates. The failure is due to the lack of a general framework which would help in presenting expectations as well as observations. This unfulfilled part of the study would have been valuable in dealing with policy questions.

List of Variables in the (Opera) Data

1. General data as to the year of establishment, incorporation, ... etc.
2. Home performances: capacity of theater, attendance, price of admission, ... etc.
3. Tour performances: length of tour, audience composition, ... etc.
4. Staff expenses: artistic, administrative and technical staff.
5. Performers: full-time, part-time, salaries, ... etc.
6. Expenditures and costs.
7. Income data.

K. National Research Center of the Arts, Inc.
Study of State Art Agencies: A Summary Report
Conducted for NEA, 1976

1. Summary

a. Intention/Purpose:

The goal of this study was to provide State arts agencies with a block of data from which more informed policy decisions could be made by each individual agency. This goal was to be implemented by data collection reflecting the sources of funding, expenditures, and internal structure of each arts agency.

b. Model and Findings:

No specific hypotheses were initially proposed. The sole purpose of the study was data collection and assessment.

From each State arts agency, the following variables were collected:

- Sources of funds
  - .. State
  - .. Federal (NEA)
  - .. Private and corporate contributions
  - .. Local government
- Funding of Associated Foundations
  - .. State
  - .. Federal
  - .. Private
  - .. Local
- Expenditures
  - .. Arts and Cultural Organizations (broken down by media and type)
  - .. Other organizations (schools and public broadcasting)
  - .. Individuals
  - .. Other (agency expenses)

- Secondary Recipients (arts organizations will often support other organizations or individuals; in this case these data are unreliable as these organizations were not interviewed directly).
- Distribution of Expenditures by Art Form
  - .. Music
  - .. Theater
  - .. Dance
  - .. Combination of Arts
  - .. Visual Arts
  - .. Public Media
  - .. Literature
  - .. Other Art Forms
  - .. Non-art humanities
- Type of Activity Assisted (program support, salaries, touring expenses, etc.)
- Source of Funding initiation and period of funding
- Demographic data on State agency personnel.

These data from fiscal year 1974 were from questionnaires completed by 55 State and Territory Arts Agencies.

Statistical techniques were limited to simple tabulations. As a result, the findings stated in this study were limited to descriptions of the tabulation results.

c. Conclusions

Conclusions in this study were limited to entirely subjective statements regarding future trends in funding and expenditure.

2. Critique

a,b Omissions and Critical Comments

With respect to the initial statement of purpose, there were no omissions. However, the usefulness of this study must be limited by the fact that it is not time series data. Statements regarding changes in funding level and distribution in the future cannot be taken too seriously.

c. Related Studies

No related studies on similar variables of State Funding are known at this time. NEA does publish yearly reports regarding their funding of arts and cultural institutions. These studies may all be used in conjunction.

L. National Research Center of the Arts, Inc., A Study of the Non-Profit Arts and Cultural Industry of New York State, Study No. A002, March 1972

1. Summary

a. Intention or Purpose:

The stated aim of the study was given as "...an industry looks at the arts organizations and cultural institutions of New York State. ...(They) are viewed from the perspective of employers of capital and labor, purchasers of goods and services and producers of a valuable service product benefiting many levels of society. " (Preface)

The study divides the state of New York into six regions:

- New York City
- New York City suburbs to mid-Hudson
- Upper Hudson to St. Lawrence
- Southern Tier East to Central
- Southern Tier Central to Finger Lakes
- Southern Tier West to West

Aggregates are presented for each of the regions.

Another breakdown is by size of operating budget. The grouping is as follows:

- $5,000-49,000
- $50,000-249,999
- $250,000 and over

The breakdown for organizations is as follows:

- Performing Arts
  .. Music, theatre, dance, presenters
- Visual Arts and Museums
  .. Visual arts groups, museums, arts councils

The areas of analyses were:

- Income gap
- Manpower
- Management
- Production and services
- Costs to the consumer
- Future of the industry

The survey was conducted for a sample of 589 organizations from a population of 3000. The fiscal year surveyed was 1970-71.

b. Model and Findings:

The following is a summary of the main findings:

- An income gap exists for 54% of the organizations surveyed.
- Earned income is the major source of income for these organizations followed by private donations and lastly by public grants.
- Artistic personnel received the largest proportion of personnel expenses. Administrative personnel received the second largest proportion except for museums where they received the largest proportion.
- Most organizations offered reduced rates based on age or membership. In addition, free admission was offered by all at one time or another with some organizations eliminating the admission fee altogether.
- The majority felt that governmental subsidies should be increased.

c. Conclusions:

No conclusions were offered.

2. Critique

a. Omissions:

The study did not set up a model to explain its findings. It did not analyze its findings. It also missed the opportunity of using cross analysis.

b. Critical Comments:

The study is a survey of non-profit organizations at a point in time. It does not present changes in the organizations over time.

The study is highly aggregated with the smallest unit of analysis being one of the six regions in the state.

M. Poggi, Jack, Theater in America: The Impact of Economic Forces, 1870 - 1967, Cornell University Press, Ithaca, New York, 1968

1. Summary

a. Intention or Purpose:

The study of the market organization for commercial and noncommercial theater over the period 1870 - 1968.

An analysis of the economic forces that led to growth and decline of various groups within the theater such as the touring groups and Broadway.

b. Model and Findings:

None

c. Conclusions:

The monopolization of commercial theater that was achieved under the Syndicate and the Shubert brothers was weakened by 1956. Poggi suggests that "...some measure of open competition in theatrical real estate" emerged from this year on. (p.26)

The theater developed during this period as follows: centralization of production, "division of labor", "standardization of product" and "growth of control by big business" (p 26).

The decline of the road is viewed as "...the beginning of a general and apparently permanent decline that did not become evident on Broadway till the late 1920's." (p33) The road productions were faced with a cost increase. This led to pressures for a larger percentage of the profits, which cut in the local theaters take. In some cases the result was the closing down of one-night stands where costs were higher than revenue in many instances. The squeeze on revenue was due to the emergence of competition from the movies, the increased mobility, autos, and the entertainment role of radios.

Broadway experienced its boom period in the mid-twenties. Prior to that a constant increase in activity took place and a definite decline occurred following 1925-26 season. The boom is given as a result of:

1) the theater being more entrenched in New York and the major cities,

2) increased urbanization,

3) the postwar prosperity especially in non-rural areas.

The reasons above also account for the time difference in the decline of the road and Broadway.

The decline of Broadway is attributed to the increase in costs, risk and competition from the movies. The main factor seems to be the movies which presented a competitive product at a lower price. Movies also attracted some of the top talent in the theater once talkies were introduced. Given the increased cost, theater could not compete successfully with movies.

The noncommercial theater was one approach to lower costs. Production costs were small and the theaters were often converted structures that lacked many of the features found in the commercial theaters. Thc turnover was high and financial difficulties were the rule.

The Off-Broadway movements gained strength due to the limited opportunities in the existing commercial theater. The costs of production were minimal since actors did not always receive pay. Prior to 1952 "Everybody did everything" (p. 192) but this changed as actors' pay become equity minimums, directors, designers and authors received higher percentages, salaries or royalties. Off-Broadway experienced a decline similar to Broadway's. Costs and risk increased and Poggi suggests that the low price of foreign films might have been the other source of a squeeze that contributed to the decline. Currently it "...appears to be a miniature Broadway, useful to the larger theater as a barometer of changing trends in drama and as a testing ground for new actors and directors." (p. 194).

Off Off-Broadway emerged as a revolt against the new conventionality of Off-Broadway. It has maintained its freedom by keeping its costs at a minimal level, "Technically, everybody is an amateur..." (p 199) It, undoubtedly, will face the choices that were faced by Off-Broadway of freedom verses growth.

The resident-theater movement has not been successful. Its accomplishments were considerable in the sixties compared to the previous fifty years. It provides avenues for various segments of society to let themselves be heard.

2. Critique

a. Omissions:

The title stated that the impact of economic forces on the theater will be studied, but the study failed to quantify such an impact.

b. Critical Comments:

The study limited itself to a descriptive approach to the issues. Its analyses were relevant but would have been more helpful if some quantification, where possible, of the relationships was attempted. This would be beneficial to both the theater industry and the policymakers.

The study is valuable in understanding the theater, its various components and the economic forces that led to the growth and decline of each.

N. Schwartz, R.A.
"Personal Philanthropic Contributions"
Journal of Political Economy, 11-12/1970, pp. 1264-91

1. Summary

a. Intention/Purpose

Schwartz goal was to incorporate philanthropy into traditional utility theory and separate that portion of philanthropic activity which is truly altruistic from that which may reflect motives of ultimate personal gain.

b. Model and Findings

- Schwartz assumes that the utility of the contributor (U^a) is a function not only of his own personal consumption (C^a), but of the consumption of another individual as well (C^b)

1. $U^a = U^a(C^a, C^b)$ and $U^b = U^b(C^b)$

He measures donations from a → b as D^{ab}, and y^a and y^b are incomes before the donation has taken place, then he makes two statements.

2. $D^{ab} = y^a - C^a = C_b - y^b$

3. $C^b = (y^a + y^b) - C^a$

Statement 3 is, in effect, the equation of a budget constraint under the assumption that there exists a "unitary price for giving," or that income transfers are costless. We know that tax rates affect the price of giving and would result in a non-linear constraint but he ignores this complication.

From equations 1 and 2, he arrives at the following:

4. $dU^a / dD^{ab} = dU^a / dC^a \cdot dC^a / dD^a + dU^a / dC^b \cdot dC^b / dD^{ab}$

From this equation (assuming a unitary price for giving), the criterion for continued donation must be considered to be:

5. $dU^a / dC^b > dU^a / dC^a$

- The variables Schwartz used are the following:

  D is constant dollar donations

  P is the ratio of the price of giving relative to the price of consumption

  Y_s is the constant dollar sample income

  Y_o is the constant dollar average level of national income

  t is a trend variable

  d_1 is a dummy for WWII

  d_2 is a dummy for the years before the presence of the standard deduction.

  All of the variables (other than the WWII dummy) were from various editions of IRS' Statistics of Income, Personal Returns.

- Schwartz proposed an analytic relationship of the form:

  6. $D = D(P, Y_s, Y_o)$

  Differentiating 6. While holding Y_o constant, Schwartz arrives at:

  7. $$dD = \left(dD / dP\right)(dP) + \left(dD / dY_s\right)(dYs)$$

  This can be adjusted to an equation in natural log form:

  8. $$dD/D = \left(N_{DP}\right)(dP/P) + \left(N_{DY_s}\right)\left(dY_s / Y_s\right)$$

  From this basis, Schwartz estimated the following equations:

  9. $$D = aP^{b_1} Y_s^{b_2} e^{b_3 t} e^{b_4 d} e^{b_5 d_2} \text{ and}$$

  10. $$D = a P^{b_1} Y_s^{b_2} Y_o^{b_3} e^{b_4 t} e^{b_5 d_1} e^{b_6 d_2}$$

  Regression coefficients and price and income elasticities are calculated from these equations.

- Regressions were run for three separate income classes. From these results, donations appear to respond inelastically to price, own income and non-sample income.

- Schwartz concludes that donations appear to react normally to changes in income and price. This being the case, it would be difficult to judge the effects of a change in tax rates upon the rate of giving as price and income effects move in opposite directions.

2. Critique

- As Schwartz points out; price, own income, and non-sample income are all likely to move over time in the same direction. As a result, it is likely that some of the estimated coefficients are biased. The consistency of the qualitative results, however, tends to lend credence to Schwartz's results.

Q. Seaman, Bruce, A., "The Pattern of Performing Arts Financing," Urban Economics Workshop, June 2, 1976.

1. Summary

a. Intention or Purpose:

The author studies the private-government contributions and grants mix for the performing arts. This is based on modeling the behavior of each of the two groups and the factors that influence its contributions and grants.

b. Model and Findings:

The private groups, acting as utility maximizers, have to allocate their income among various commodities and services. They can also affect the behavior of governmental organizations so that subsidies are provided to the producers in order to lower prices. The incentive for such behavior by private groups is dependent on the difference between the private and public price of giving. The private price (P_p) is given as:

$$P_p^i = (1-t_y^i)(1-m_f) + (b^i/B_F)m_f$$

where:

P_p^i: the private price of contributing by the ith household

t_y^i: the marginal tax rate faced by the ith household

m_f: the percentage of a dollar received by an arts organization that is paid by a government above the metropolitan level

b^i/B_F: the ith household's share of the federal or state tax

The price of having the local government make the grant or contribution on behalf of the household is:

$$P_g^i = (1-t_y^i)[1-m_f)b^i/B_L] + (b^i/B_F)m_f$$

where:

P_g^i: the price to the ith household of having the local government make the contribution

b^i/B_L: the ith household's share of the local tax base

The remaining variables were explained above. In general, we can compute the difference for (P_p and P_g) as follows:

$$P_p - P_g = (1 - \frac{b}{B_L})[(1-t)(1-m)]$$

Since $\frac{b}{B_L} < 1$, we expect $[(P_p - P_g) > 0]$. This implies that there is a net gain to private groups when the governmental agencies provide the grant. This leads to the formation of a "pressure group" to obtain the grants.

The author goes on to discuss the externalities from having performing arts institutions in a given location. This leads to modifications in the behavior of the firms in the area. Thus, we should expect these firms to contribute on two accounts:

- The managers maximize their own utility by some form of contribution to the performing arts institutions.
- The firm's profit-maximizing behavior might lead it to contribute to the arts organizations since it can benefit from the externalities generated by these organizations.

c. Conclusions:

Seaman concluded that, "In general the results are mediocre." (P.38). This referred to the relationship between grants and contributions from a given source, or the ratio of such from two given sources, and the following set of variables:

- income distribution measures for the area,
- educational attainment measures for the area,
- measures of externalities from the performing arts institutions in the area, and
- grants by the NEA to the institutions in the area.

2. Comments:

The study begins with the assumption that the price of the product in the performing arts is less than its average cost. Therefore, grants and contributions must be forthcoming in order to produce. Three sources of such aid are given: private, governmental and business. Private groups "lobby" for governmental subsidies to the extent that they can shift the cost of their own contributions to the rest of the population. The same is true for business managers who also contribute in order to maximize the externalities of having these institutions in the area.

There is an absence of the role of managers of governmental agencies as utility maximizers. In addition, the governmental agencies might in turn try to modify the behavior of private and business groups and consequently their contributions. This might suggest a complex of lags which would complicate the analysis. These lags might be institutionally determined, such as legislative lags, or due to the operations of the economy, such as the externalities.

APPENDIX B

EQUATION ESTIMATES FOR ALTERNATIVE SPECIFICATIONS FOR EACH MODEL

A. Introduction

The procedure employed in arriving at the "best" equation specifications (i.e., those appearing in Section VII of the study) started with the development of separate conceptual models for each of the separate art forms. This model conceptualization served two purposes. The first was to reduce the set of potential explanatory variables to a manageable number. That is, out of the universe of variables available to the researcher, economic theory and knowledge concerning the institutional assignments for each art form were combined to define that set of variables which would encompass those factors likely to influence the behavior of the art form under consideration.

The second purpose of the modelling effort was to indicate which variables or measures of phenomena are likely to be alternatives. Clearly, the conceptual specifications of Section V include alternative measures of the same factors. The choice between these measures is an empirical issue.

Therefore, a series of regressions was conducted for each behavioral equation in which alternative measures or combinations of measures were put to the test. Information from one regression regarding the reactions of coefficients to the introduction and/or removal of selected variables or groups of variables was used to further modify the specification. This process was quite involved for each equation, and was largely based on statistical issues, having previously used economic theory to define those variables or sets of variables eligible for inclusion.

The empirical results presented in this Appendix for each art form represent key points in this iterative process. They are ordered for easy presentation and their order does not necessarily represent the order in which they were generated. Obviously, time and space do not permit a full explanation of the sequential process used to arrive at each and every equation. Rather, the key milestones of this process, as given by the estimates included in this Appendix, will provide sufficient information to the interested reader.

Finally, it must be emphasized that, in no sense, can the procedure used be categorized as a random or stochastic process of attempting every combination of variables for a given equation. Beside the fact that the project resources would not permit such a process, the set of potential explanatory variables was defined by economic theory and the choice among alternative measures of a particular cause was accomplished by using standard statistical procedures.

B. Appendix Tables

TABLE B.1: THE VARIABLES USED IN THE DEMAND FUNCTIONS FOR THE FOR-PROFIT THEATER MODEL

Variable	Description
P	The price of admission (total revenue for the given period/total attendance for the period)
PC2	Consumer price index for services less rent, 1972 = 100
PS	The consumer price index for reading and recreation, 1972 = 100
Tr	A trend variable, the last two digits for the year of the data
Um	Unemployment rate for whites, a proxy for the rate of unemployment for the typical theater audience
Y	Per capita disposable personal income in 1958 dollars

TABLE B.2: ESTIMATED AVERAGE FEBRUARY ATTENDANCE FOR ALL SHOWS -- For-Profit Theater[1/]

Equation	P	Y	PS	Un	Tr	PC2		Constant	R^2	Number of Observations	CO
1	-10.8167 (-1.6292)	.0734 (1.6469)	-.2281 (-.2989)					111.1566 (2.1846)	.5211	30	Yes
2	-17.3927 (-2.5807)	.0324 (1.4577)		7.8754 (1.9791)				167.7845 (4.1254)	.3797	18	No
3	-12.4084 (-1.4801)	.1063 (1.3772)	-2.1404 (-1.0)	9.9124 (2.2172)				173.7737 (4.2269)	.4240	18	No
4	-14.0808 (-1.4854)	.0639 (.5065)	-2.3645 (-1.0412)	8.9425 (1.7427)	1.9632 (.4333)			172.0085 (4.0327)	.4329	18	No
5	-19.4815 (-2.3144)	-.0066 (-.0723)		6.8911 (1.4748)		.6634 (.4389)		206.6949 (2.1079)	.3888	18	No

[1/] The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination; CO column indicates whether or not the Cochrane-Orcutt method was used in the estimation.

B.3

TABLE B.3: ESTIMATED AVERAGE FEBRUARY AUDIENCE SIZE PER PERFORMANCE FOR ALL SHOWS -- For-Profit Theater[1/]

Equation	P	Y	PS	Un	Tr	PC2		Constant	R^2	Number of Observations	CO
1	-1.0296 (-1.6615)	.0028 (.8066)	.0381 (.6348)					15.8713 (3.6366)	.3997	31	No
2	-1.8954 (-3.0880)	.0028 (1.3893)		.6011 (1.6587)				21.3752 (5.7707)	.4179	18	No
3	-1.6973 (-2.1570)	.0058 (.7937)	-.0851 (-.4233)	.6821 (1.6254)				21.6132 (5.6009)	.4258	18	No
4	-2.0905 (-2.4528)	-.0042 (-.3715)	-.1377 (-.6746)	.4540 (.9841)	.4616 (1.1330)			21.1982 (5.5276)	.4813	18	No
5	-2.4013 (-3.2837)	-.0066 (-.8325)		.3627 (.8936)		.1607 (1.2236)		30.7994 (3.6154)	.4780	18	No

[1/] The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination; CO column indicates whether or not the Cochrane-Orcutt method was used in the estimation.

BEST COPY AVAILABLE

TABLE B.4: ESTIMATED AVERAGE FEBRUARY WEEKLY ATTENDANCE FOR PLAYS -- For-Profit Theater[1/]

Equation	P	Y	PS	Un	Tr	PC2		Constant	R^2	Number of Observations	CO
1	-9.2774 (-1.4962)	.0195 (.6685)	-.5016 (-.9668)					133.7408 (4.1005)	.1843	31	No
2	-14.1841 (-2.0536)	-.0116 (-.4733)		-1.1716 (-.2753)				179.4558 (4.1018)	.3339	18	No
3	-5.0558 (-.9545)	.1575 (3.6133)	-4.9901 (-4.1448)	6.3989 (2.2619)				206.4631 (9.6343)	.6940	17	Yes
4	-8.3930 (-1.4442)	.0846 (1.1254)	-5.0319 (-4.4446)	4.8581 (1.6020)	2.8206 (1.1311)			205.6878 (10.2191)	.7221	17	Yes
5	-4.0147 (-.6532)	.0765 (2.6931)			-3.1725 (-3.2948)			141.5719 (4.9945)	.3733	37	No
6	-8.5183 (-1.2471)	.0257 (.7017)	-.2516 (-.2489)		-.7042 (-.2900)			137.8808 (3.8168)	.1870	31	No

[1/] The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination; CO column indicates whether or not the Cochrane-Orcutt method was used in the estimation.

TABLE B.5: ESTIMATED AVERAGE FEBRUARY WEEKLY ATTENDANCE FOR MUSICALS -- For-Profit Theater[1/]

Equation	P	Y	PS	Un	Tr	PC2		Constant	R^2	Number of Observations	CO
1	-.5542 (-.1393)	.0244 (.6880)	.6651 (1.1051)					-13.8041 (-.4161)	.6529	30	Yes
2	1.0625 (.2515)	.0378 (1.7444)		6.9423 (1.8346)				-3.8546 (-.6758)	.4693	18	No
3	-.2991 (-.0670)	-.0173 (-.2827)	1.5689 (.9613)	5.2604 (1.2589)				-39.2362 (-1.0102)	.5045	18	No
4	-.2489 (-.0533)	-.0247 (-.2690)	1.4604 (.7470)	5.0427 (1.0589)	.4217 (.1120)			-39.8106 (-.9774)	.5050	18	No
5	-.9386 (-.2342)	.0478 (1.1567)			.4342 (.3197)			-26.0986 (-.8048)	.6384	30	Yes
6	3.5792 (1.0802)	.0946 (3.3042)	2.2475 (2.5145)		-5.0630 (-2.5166)			-6.3384 (-.2325)	.7216	31	No

[1/] The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination; CO column indicates whether or not the Cochrane-Orcutt method was used in the estimation.

BEST COPY AVAILABLE

TABLE B.6: THE VARIABLES USED IN THE MODELS FOR NON-PROFIT ART ORGANIZATIONS EXCLUDING MUSEUMS 1/

Variable	Description
A	Annual total ticketed attendance
ΔA	Annual change in total ticketed attendance
ATPR	Ratio of profits after income taxes to stockholders' equity for all manufacturing corporations
AU	Percent seat capacity filled
AWEMAN	Average gross weekly earnings for manufacturing, 1972=1.00
BNEA	Annual appropriations by the National Endowment for the Arts to various programs and agencies
BTPR	Ratio of profits before income taxes to stockholders' equity for all manufacturing corporations
C	Annual total operating expenditures less the costs of fund raising
CAdv	Annual fund raising costs and fees
CMPHR	Compensation per hour in private non-farm sectors, 1972=1.00. Wages and salaries of employees plus contributions for social insurance and private benefit plans. Also includes an estimate of wages, salaries, and supplemental payments for the self-employed
CPr	Annual total local nongovernment contributions
Crm	Violent crime rate for the U.S. per 100,000 inhabitants, offenses of murder, forcible rape, robbery, and aggravated assault
Cty	Total seats available -- main season and other
ΔCty	Change in total seats available -- main season and other
DFM	A dummy variable for the years 1965-66 through 1970-71, the years the Ford Foundation Symphony Program was in its matching funds stage
DSF	Balance of the surplus-deficit fund at the end of the year
DSFR	The ratio of the surplus-deficit fund to the operating budget
GF	Annual federal grants
GFn	Annual foundation grants
GNP	Gross National Product in billions of 1972 dollars
ΔGNP	Annual change in GNP in billions of 1972 dollars
GR	Annual total local government grants
LOS	Aggregated length of season for the sample in weeks
NC	Annual total operating expenditures net of total unearned income (grants, contributions, and corpus earnings used for operations).
NCA	Annual total operating expenditures net of total unearned income per ticketed attendee
NPL	Number of players in the 17 symphony orchestras (ASOL)
ΔOC	Change in total governmental and foundations grants
P	Average realized price of admission
PDA	Percentage change in annual total attendance
PDGNP	Percentage change in the gross national product
PS	Consumer price index for reading and recreation, 1972=1.00
PC1	Consumer price index for transportation services, 1972=1.00
PC2	Consumer price index for services less rent, 1972=1.00
Q	Annual total ticketed performances
ΔQ	Change in annual total ticketed performances
Sbr	Annual total of subscriptions purchased
SE	Stockholders' equity for all manufacturing corporations in billions of 1972 dollars
SPI	Standard & Poor's common stock price indexes, (500 stocks)(1941-43 = 10)
t	Average tax rate, ratio of the receipts of the federal, state and local government to the National Income
Tr	A trend variable, the last two digits for the year of the data
Um	Unemployment rate for whites
X	Annual seating capacity expansion factor
YD	Per capita disposable income in 1972 dollars
YDT	Total disposable income in billions of 1972 dollars

1/ All monetary values are in 1972 dollars.

TABLE B.7: ESTIMATED AVERAGE UTILIZATION RATE -- All Non-profit Art Organizations Excluding Museums[1/]

Equation Number	P	YD	PS	PC1	Um	Cty	Q	Crm	YDT	Constant	R^2
1	20.5894 (2.0838)	-0.0176 (-1.2906)	-253.7579 (-2.0189)	252.8815 (2.0056)	-15.3863 (-2.1029)					117.8572 (4.4778)	.6608
2	5.8417 (1.1129)	-0.0135 (-2.4869)	-95.5663 (-1.5352)	199.8026 (3.9063)	-8.7900 (-2.6794)			-0.1172 (-4.1750)		88.4835) (7.0740	.9651
3	-10.6377 (-2.1898)	-0.0077 (-0.9393)	31.4862 (0.6304)	135.4252 (1.8449)		0.00000183 (0.9674)		-0.2145 (-2.7997)		52.5391 (3.5225)	.8908
4	1.1417 (0.3635)	0.00372 (0.3282)					0.000556 (0.2520)	-0.0288 (-1.0507)		60.4559 (3.0263)	.3542

[1/] The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination.

TABLE B.8: ESTIMATED ANNUAL TOTAL TICKETED ATTENDANCE -- All Non-profit Art Organizations Excluding Museums[1/]

Equation Number	P	YD	PS	PC1	Um	Cty	Q	Crm	YDT	Constant	R^2
1	-134099.75 (-0.4807)	-317.5349 (-0.3157)					1119.4104 (5.4866)	2261.0239 (0.9285)		1482049 (.8353)	.9777
2	-1197602.0 (-1.7640)	1507.4731 (0.5510)	16692085.0 (1.0587)					-13559.5195 (-1.0773)		2498504.0 (.5316)	.8513
3	-180353.0 (-2.3610)	-1295.4619 (-0.9989)	4018256.0 (0.5116)	2341394.0 (2.0284)		1.0942 (3.6793)		-35630.7852 (-2.9580)		3886094.0 (-1.6569)	.9882
4	-923504.9375 (-1.6001)	3234.6265 (4.1875)								5492655.0 (2.9779)	.8062
5	-907635.1875 (-1.4437)	3715.0264 (2.0724)						-1835.4126 (-0.3032)		4292343.0 (0.9675)	.8097
6	-156520.8 (-0.5711)	427.8560 (0.7164)					1061.3340 (5.5422)			288184 (0.2390)	.9729

[1/] The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination.

TABLE B.9: ESTIMATED TOTAL OPERATING EXPENDITURES NET OF FUND RAISING COSTS -- All Non-profit Art Organizations Excluding Museums 1/

Equation Number	Q	Q^2	CMPIIR							Constant	R^2
1	-83567 (-0.4718)	5.5680 (0.6667)								408797184.0 (0.4361)	.8037
2	12597.254 (2.9294)		118432160.0 (6.3908)							-78850096.0 (-2.2485)	.9730

1/ The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination.

TABLE B.10: ESTIMATED AVERAGE REALIZED PRICE PER TICKET SOLD -- All Non-profit Art Organizations Excluding Museums 1/

Equation Number	DSPR	NC	NCA	NCA_{-1}	P_{-1}					Constant	R^2
1	-2.1083 (-0.9444)		0.6434 (5.0949)		-0.2712 (-1.2712)					1.2177 (1.6868)	.9539
2	-1.6531 (-0.7079)		0.5263 (5.7487)							0.8170 (1.1870)	.9353
3			0.6840 (5.8248)		-0.2389 (-1.1468)					0.7830 (1.4234)	.9437
4	-10.0206 (-2.0059)			-0.8138 (-1.6898)	1.7167 (2.2289)					2.6106 (1.7962)	.7987
5	4.2419 (1.0950)	0.00000006 (3.7127)			-0.6870 (-1.8241)					2.2122 (2.4700)	.9224

1/ The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination.

TABLE B.11: ESTIMATED ANNUAL FEDERAL GRANTS -- All Non-profit Art Organizations Excluding Museums[1/]

Equation Number	Q	BNEA	GNP	GF_{-1}	PDGNP	A				Constant	R^2
1		-0.0369 (-0.2854)		1.2631 (1.7122)	-5441338.0 (-0.2855)	0.5531 (0.3348)				-5901925.0 (-0.2853)	.9249
2		0.1664 (2.6824)			-12577184.0 (-0.5575)	-0.8463 (-0.4840)				11790026.0 (0.5402)	.8516
3	-362.2905 (-0.4611)	0.1075 (1.8992)	7351.4414 (1.2481)							-2588175 (-0.2948)	.8984
4	-151.0 (-0.1883)	0.1561 (3.6376)								2468180 (0.3031)	.8667

[1/] The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination.

TABLE B.12: ESTIMATED ANNUAL GRANTS FROM REGIONAL GOVERNMENT AGENCIES -- All Non-profit Art Organizations Excluding Museums [1/]

Equation Number	Q	$BNEA_{-1}$	PDGNP	GR_{-1}	GNP	A				Constant	R^2
1	-589.9973 (-2.1103)	0.0676 (4.1202)	-6115825 (-1.9325)	-0.0485 (-0.2283)						8707524 (2.9904)	.9679
2		0.0533 (2.9144)	-7771024 (-1.6778)	0.0419 (0.1353)		-0.3587 (-1.0589)				6794274 (1.7098)	.9419
3	-664.3662 (-1.6762)	0.0926 (3.9032)		-0.00564 (-0.0164)	-1300.58 (-0.8221)					10385472 (2.2534)	.9412
4		0.0540 (3.5352)	-7508392 (-2.0553)			-0.3407 (-1.2587)				6653485 (1.9972)	.9416
5	-665.9216 (-1.9981)	0.0926 (4.5542)			-1316.3523 (-1.2102)					10405546 (2.7043)	.9462

[1/] The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination.

TABLE B.13: ESTIMATED ANNUAL PRIVATE CONTRIBUTIONS -- All Non-profit Art Organizations Excluding Museums[1/]

Equation Number	A	CAdv	t	SE	BTPR	ATPR	SPI	$CAdv_{-1}$		Constant	R^2
1	2.2250 (1.0479)		1859637.0 (3.2144)				122293.0 (1.0241)	-2.1518 (-1.1387)		-72697744.0 (-4.3512)	.9457
2			440284.0 (0.3502)	267031.8125 (1.7550)				-1.9858 (-1.2625)		-63375536.0 (-5.1703)	.9444
3			7820393.0 (8.0396)		630869.8125 (1.9303)			-1.1317 (-0.7687)		-85127312.0 (-5.1087)	.9485
4			2911176.0 (8.4644)			1189610.0 (2.2011)		-1.1557 (-0.8345)		-90034496.0 (-5.3720)	.9544
5			2214449.0 (4.6749)				144982.6875 (1.2227)	-1.2590 (-0.7392)		-62418880.0 (-4.5705)	.9308
6	2.6193 (1.2483)		2083163.0 (3.8691)					-2.3596 (-1.2498)		-74487568.0 (-4.4612)	.9315
7		0.5161 (0.2014)	2375970.0 (7.3639)							-57380768.0 (-4.4530)	.9025
8			2672299.0 (9.4420)		647505.0 (2.0569)					-81077232.0 (-5.3126)	.9424
9			2759893.0 (9.6910)			1213896.0 (2.3085)				-85843296.0 (-5.5098)	.9480

[1/] The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination.

TABLE B.14: ESTIMATED ANNUAL GRANTS BY FOUNDATIONS -- All Non-profit Art Organizations Excluding Museums[1/]

Equation Number	A	X	DSFR	Q	DMM	ΔCty	DSF			Constant	R^2
1		-7278909. (-0.7254)		106.9041 (0.1434)	3964650. (5.3345)					11485297. (1.2734)	.8844
2	4.0724 (3.4463)	-21028608. (- 3.4463)	8374874 (3.5933)		1949625. (2.9898)					-22017712 (-2.0837)	.9781
3	4.0737 (2.9487)	-17977328 (-2.7151)			1254780. (1.3165)		.6023 (3.0684)			-24303248 (-1.8728)	.9720
4				1029.84 (1.1027)	4135485 (6.6477)	12476.03 (1.8314)				-5531[illegible]0 (-0.5449)	.9398
5		-25088976 (-9.0964)	67437968 (9.6428)	4285.87 (9.3308)	2497796 (12.1932)					-13959027 (-4.3383)	.9964

[1/] The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination.

TABLE B.15: ESTIMATED CAPACITY EXPANSION FACTOR -- All Non-profit Art Organizations Excluding Museums[1/]

Equation Number	Q	PDA	Q_{-1}	AU					Constant	R^2
1		0.6934 (3.3865)							0.9683 (93.0882)	.6964
2	-0.0000019 (-0.1625)	0.7141 (2.7312)							0.9913 (6.9798)	.6984
3	0.0000045 (0.2444)			0.0109 (1.0434)					0.09162 (0.1235)	.2389
4				0.0119 (1.3379)					0.0727 (0.1073)	.2298

[1/] The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination.

TABLE B.16: ESTIMATED ANNUAL FUND-RAISING EXPENDITURES -- All Non-profit Art Organizations Excluding Museums[1/]

Equation Number	DSFR	CPr_{-1}	ΔQ	DSF	ΔOG	DSF_{-1}				Constant	R^2
1	9570114 (.6013)	.0227 (.2845)	-17.5706 (-0.4145)							917036.8125 (.3617)	.2818
2					.0307 (.8481)	.0259 (1.1356)				1568631 (13.6179)	.2499
3		.01928 (2730)	-21.0758 (-.6325)	.05712 (.6301)						1042046.1875 (.4634)	.2846

[1/] The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination.

B.11

TABLE B.17: ESTIMATED SUBSCRIPTION SALES -- All Non-profit Art Organizations Excluding Museums[1/]

Equation Number	P	Sbr_{-1}	Tr	P^2						Constant	R^2
1	728269.6875 (2.4042)	0.1531 (0.5079)	62269.2617 (0.9828)							-7048208.0 (-1.8986)	.9077
2	865956.375 (3.2334)	0.3739 (1.8640)								-3602785.0 (-2.9476)	.8898
3	1229797.0 (5.7646)									-5113771.0 (-4.8341)	.8260
4			83400.75 (2.1120)	75904.375 (2.7003)						-6652904.0 (-3.0066)	.9058
5				123338.6875 (5.9691)						-2064553.0 (-4.0201)	.8358

[1/] The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination.

TABLE B.18: ESTIMATED AVERAGE UTILIZATION RATE -- Non-profit Theater[1/]

Equation Number	P	YD	PS	PC1	Um	Cty	Q	Crm	YDT	Constant	R^2
1	5.5419 (1.2164)	-0.0103 (-0.3259)	-227.6960 (-0.8835)	202.0727 (0.8515)	-6.7642 (-0.6611)					144.0029 (1.6209)	.5763
2	0.4133 (0.2094)	-0.0211 (-1.8193)	-64.8597 (-0.6565)	337.4751 (3.7536)	-8.5339 (-2.3161)			-0.3101 (-4.6242)		55.1116 (1.4824)	.9638
3	5.5143 (2.2986)								-0.0511 (-1.5845)	82.1189 (5.7715)	.5040

[1/] The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination.

TABLE B.19: ESTIMATED ANNUAL TOTAL TICKETED ATTENDANCE -- Non-profit Theater[1/]

Equation Number	P	YD	PS	PC1	Um	Cty	Q	Crm	YDT	Constant	R^2
1	-150079.5 (-1.8956)	750.3801 (1.0904)	9717458.0 (2.2727)					-10375.5781 (-2.9658)		-4646603.0 (-3.1144)	.9212
2	110576.1875 (1.017)	776.8982 (2.5703)			-178809.125 (-2.1133)					119316.4375 (0.1501)	.8580
3	-42993.3125 (-0.4230)	921.0598 (2.4903)								-456087.5625 (-0.4863)	.7312
4	-28140.5703 (-0.2236)			-1292215.0 (-0.5656)					5226.7539 (2.1011)	80196.625 (0.1044)	.7450
5	64338.1719 (0.4551)	862.6689 (0.5918)	4092599 (0.4149)	-3935199 (-0.5255)		.0319 (.0408)				-1194578 (-.4925)	.8580
6	-92090.375 (-0.6442)	-97.6211 (-.0837)	5230575 (0.7297)	4037832 (0.5922)		.5573 (.8867)		-10603.8711 (-1.9292)		-3335476 (-1.6056)	.9504
7	-56876.422 (-0.6203)	1833.9124 (2.7293)						-3212.5386 (-1.5627)		-2608683 (-1.6158)	.8194

[redacted] The values enclosed in parentheses are the t statistics; [redacted] is the unadjusted coefficient of multiple determination.

TABLE B.20: ESTIMATED TOTAL OPERATING EXPENDITURES NET OF FUND RAISING COSTS -- Non-profit Theater[1/]

Equation Number	Q	Q^2	CMPHR							Constant	R^2
1	6016.960 (2.4860)		34004096.0 (5.4399)							-40287104.0 (-3.2014)	.9157
2	-16672.782 (-.2295)	1.9532 (0.3126)	33337744.0 (4.6895)							25893712.0 (0.1220)	.9173
3	12537.118 (2.6441)									-50323072.0 (-1.7928)	.4997

[1/] The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination.

B.13

TABLE B.21 ESTIMATED AVERAGE REALIZED PRICE PER TICKET SOLD -- Non-profit Theater[1/]

Equation Number	DSPR	NC	NCA	NCA_{-1}	P_{-1}					Constant	R^2
1	-2.2577 (-0.5888)		0.7549 (4.3466)		0.2521 (1.2857)					-1.0792 (-1.1657)	.9422
2	-17997 (-0.4434)		0.9096 (6.8305)							-0.8422 (-0.8730)	.9183
3			0.7273 (4.6644)		0.2414 (1.3260)					-0.7324 (-1.0997)	.9372
4	-1.9257 (-0.4914)	0.00000032 (4.2071)			-.2629 (-.8755)					0.7502 (0.9369)	.9390

[1/] The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination.

TABLE B.22: ESTIMATED ANNUAL FEDERAL GRANTS -- Non-profit Theater[1/]

Equation Number	Q	BNEA	GNP	GF_{-1}	PDGNP	A				Constant	R^2
1	-622.689 (-3.4209)	0.0836 (3.4208)	-5302.3671 (-5.0826)	-0.3941 (-2.4903)						9798327 (5.0269)	.9787
2	129.4822 (0.4467)	0.0362 2.0245	-854.0783 (-0.4878)							702750.2500 (0.2628	0.8259
3		0.0151 (1.1591)				0.8992 (1.2042)				-1526814.0 (-0.8357)	.8237
4		0.0384 (2.7337)		-0.5416 (-1.0412)	-3978992 (-1.0169)					1058280 (3.0078)	.8365
5		0.0262 (3.3482)			-2535053 (-0.6871)					793597.188 (3.6036)	.7922
6		0.0380 (2.6951)		-0.3541 (-0.7256)						821791.75 (3.3606)	.7942

1/ The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination.

TABLE B.23: ESTIMATED ANNUAL GRANTS FROM REGIONAL GOVERNMENT AGENCIES -- Non-profit Theater[1/]

Equation Number	Q	$BNEA_{-1}$	PDGNP	GR_{-1}	GNP	A				Constant	R^2
1	601.4162 (1.8630)	-0.005418 (-0.4898)	-4635097.0 (-1.4864)	-1.11967 (-1.3019)						-2148383.000 (-1.3924)	.8241
2	448.0229 (2.1946)	0.0281 (3.0571)		-1.6738 (-2.8627)	-2583.6145 (-3.2241)					1427243.000 (0.94117)	.9316
3	566.7468 (1.5424)	0.004419 (0.4368)		-0.82189 (-0.9544)						-2362636.00 (-1.3476)	.6945
4	327.0073 (1.400438)	0.009516 1.1913)								-1438039.00 (-1.0655)	0.6379

1/ The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination.

TABLE B.24: ESTIMATED ANNUAL PRIVATE CONTRIBUTIONS -- Non-profit Theater[1/]

Equation Number	A	CAdv	t	SE	BTPR	ATPR	SPI	$CAdv_{-1}$		Constant	R^2
1	0.8646 (0.5522)	3.5324 (0.9689)	896278.625 (1.9295)	-55141.2188 (-0.9134)						-16614493.0 (-3.7016)	.9250
2	-0.8919 (-0.8439)	2.9407 (0.9867)	612680.6875 (4.2332)		124301.25 (1.6011)					-20884128.0 (-4.1824)	.9448
3	-1.0312 (-0.9056)	2.9323 (0.9590)	636229.8125 (3.9978)			221914.75 (1.4961)				-21571376.0 (-3.8899)	.9419
4	-0.2943 (-0.3227)	1.6090 (0.5589)	397059.9375 (3.0482)				38081.7070 (1.7801)			-14838486.0 (-4.1420)	.9494
5		1.1559 (0.5076)	367868.8125 (4.3321)				37458.3594 (1.9406)			-14301861.0 (-4.9749)	.9481
6		2.2351 (0.8374)	477433.5625 (6.2273)							-15274439.0 (-4.4641)	.9090
7			339705.0 (5.6449)				39851.3711 (2.2744)			-13184759.0 (-7.6141)	.9454
8	-0.1976 (-0.2678)		340732.25 (4.3366)				42352.0430 (2.1937)	1.4021 (1.0973)		-13205842.0 (-7.0451)	.9581
9			472577.3125 (7.8202)		99421.0625 (1.4949)			1.0116 (0.7286)		-16777600.0 (-5.2038)	.9359
10			329056.0 (5.5790)				41257.4648 (2.4240)	1.3380 (1.1813)		-13141595.0 (-7.8334)	.9573

[1/]The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination.

TABLE B.25: ESTIMATED ANNUAL GRANTS BY FOUNDATIONS -- Non-profit Theater[1/]

Equation Number	A	X	DSFR	Q	DMM	ΔCty	DSF			Constant	R^2
1	0.3436 (0.2385)	-9241905.000 (-1.1107)	2905475.00 (0.3459)	1973.2360 (1.774)						-1355741.000 (-0.3702)	.8345
2	-1.8507 (-1.1979)	7703293.00 (1.5566)					-0.7851 (-2.4513)			-2202905.00 (-0.8778)	.7828
3		2462387 (1.0210)					-0.4302 (-3.3910)			-1296221 (-0.5196)	.7048

[1/] The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination.

TABLE B.26: ESTIMATED CAPACITY EXPANSION FACTOR -- Non-profit Theater[1/]

Equation Number	Q	PDA	Q_{-1}	AU					Constant	R^2
1		.5386 (2.6485)							.9872 (52.1279)	.5841
2	0.0001085 (1.5024)	0.3959 (1.9306)							0.3501 (0.8251)	.7341
3	0.0001079 (2.1123)			0.007265 (1.8543)					-0.1445 (-0.3305)	.5822

[1/] The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination.

TABLE B.27: ESTIMATED ANNUAL FUND RAISING EXPENDITURES -- Non-profit Theater[1/]

Equation Number	DSFR	CPr_{-1}	ΔQ	DSF	ΔOG	DSF_{-1}				Constant	R^2
1	-428492.625 (-.6272)	-0.0714 (-2.8563)	-15.5919 (-1.0814)							441632.375 (5.3188)	.7761
2					-0.0237 (-0.8771)	0.0597 (2.6819)				276588.125 (6.8935)	.5901
3		-0.06337 (-3.0556)	-9.8199 (-0.9059)							441580.4375 (5.5495)	.6724

[1/] The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination.

TABLE B.28: ESTIMATED SUBSCRIPTION SALES -- Non-profit Theater[1/]

Equation Number	P	Sbr_{-1}	Tr	P^2						Constant	R^2
1	36464.2383 (2.1782)	0.6791 (3.4168)	-12301.3125 (-1.4139)							751574.3125 (1.4866)	.8656
2	15742.3047 (1.8018)	0.7536 (3.5388)								38579.1055 (0.9878)	.8118
3				2697.9863 (2.1834)						120844.50 (3.7005)	.4051

[1/] The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination.

TABLE B.29: ESTIMATED AVERAGE UTILIZATION RATE -- Opera[1/]

Equation number	P	YD	PS	PC1	Um	Cty	Q	Crm	YDT	Constant	R^2
1	4.2683 (3.5771)	.0003 (-.0432)	75.4287 (1.2513)	-29.7786 (-.4706)	-.8970 (-.3921)					5.0873 (.2914)	.9364
2	3.6869 (3.0362)	-.0042 (-.5807)	90.6362 (1.5717)	.8068 (.0140)	-1.6692 (-.7485)			-.0464 (-1.2015)		6.0203 (.3690)	.9630
3	3.2820 (2.4709)	-.0030 (-.3577)	122.5445 (2.6218)	-40.8925 (2.0238)		.00000025 (.0727)		-.0385 (-.9110)		2.0640 (.1178)	.9528
4	4.9814 (3.4081)	.01427 (4.9840)					-.0114 (-1.9400)			-3.2717 (-.1626)	.8512
5	3.2212 (2.2818)								.0395 (3.7901)	26.2442 (1.3232)	.7094

[1/] The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination.

TABLE B.30: ESTIMATED ANNUAL TOTAL TICKETED ATTENDANCE -- Opera[1/]

Equation Number	P	YD	PS	PC1	Um	Cty	Q	Crm	YDT	Constant	R^2
1	30775.8555 (.2412)	819.4441 (1.1189)	9551968 (1.4820)	-9506973 (-1.5627)	426608.0625 (1.7439)					-3588571 (-1.9222)	.9139
2	84690.5625 (3.6171)	57.3894 (.3459)	1836555 (2.3476)	-945059.5 (-2.2727)		.8506 (11.1363)				-1836900 (-4.7434)	.9959
3	67662.9375 (2.2606)	-18.4870 (-.0987)	2485175 (2.3595)	-788164.25 (-1.7309)		.8625 (10.9371)		-898.4873 (-.9424)		-184641 (-4.6816)	.9972
4	168?54.3125 (1.6742)	949.4431 (4.7165)								-3029803 (-1.9391)	.8139
5	191085.4375 (1.6847)	669.6533 (1.2792)						1144.5083 (.5853)		-2621965 (-1.4595)	.8258
6	206351.875 (1.39301)	10?.6677 (3.5204)					-223.1932 (-0.3758)			-3459578.0 (-1.696842)	.8190

[1/] The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination.

TABLE B.31: ESTIMATED TOTAL OPERATING EXPENDITURES NET OF FUND RAISING COSTS -- Opera[1/]

Equation Number	Q	Q^2	CMPHR							Constant	R^2
1	59155.536 (.2561)	-23.3347 (-.1756)	2569616 (4.0337)							-13657494 (-.1373)	.8478
2	18624.016 (2.3747)		25611632 (4.4037)							3756818 (.5087)	.8468
3	23009.232 (1.9485)									16869904 (1.3108)	.3517

[1/] The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination.

B.19

TABLE B.32: ESTIMATED AVERAGE REALIZED PRICE PER TICKET SOLD -- Opera[1/]

Equation Number	DSFR	NC	NCA	NCA_{-1}	P_{-1}					Constant	R^2
1	11.3007 (1.9581)		.4378 (1.6919)		-.3190 (-.7934)					7.2776 (1.9676)	.6034
2	9.2028 (1.8645)		.3287 (1.5585)							5.5459 (1.9302)	.5410
3	8.9041 (1.3585)				.0427 (.1070)					9.5813 (2.3782)	.3196
4	8.7075 (1.1725)			.0532 (.1487)	.0214 (.0457)					9.0553 (1.5837)	.3233
5	12.4000 (1.6460)	.00000009 (.9634)			.0412 (.1025)					7.0835 (1.4710)	.4477

[1/] The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determinatior.

TABLE B.33: ESTIMATED ANNUAL FEDERAL GRANTS -- Opera[1/]

Equation Number	Q	BNEA	GNP	GF_{-1}	PDGNP	A				Constant	R^2
1	1220.9821 (1.2298)	0.07505 (1.9160)	1656.56 (0.8742)	-0.8014 (-0.8847)						-3052536 (-1.4681)	.9585
2	1121.5925 (1.6715)	.0531 (8.6029)								-1125997 (-1.9605)	.9445
3		.0518 (4.1623)				.5025 (.8037)				-1150940 (-1.0164)	.9312

[1/] The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination.

TABLE B.34: ESTIMATED ANNUAL GRANTS FROM REGIONAL GOVERNMENT AGENCIES -- Opera[1/]

Equation Number	Q	$BNEA_{-1}$	PDGNP	GR_{-1}	GNP	A				Constant	R^2
1	-757.1301 (-0.7232)	0.0208 (0.8244)	3070837 (0.4908)	-0.2939 (-0.3632)						1071780 (1.2407)	0.6122
2	-282.4685 (-.7825)	.00883 (1.5669)		.06297 (.1970)						699168.65 (1.8831)	.5811
3	-309.8127 (-1.0345)	.00960 (2.6098)								747617.1875 (2.9909)	.5770
4	-416.9482 (-1.0075)	.0122 (1.6665)	1029098.6 (.4235)							780472 (2.7463)	.5932

[1/] The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination.

TABLE B.35: ESTIMATED ANNUAL PRIVATE CONTRIBUTIONS -- Opera[1/]

Equation Number	A	CAdv	t	SE	BTPR	ATPR	SPI	$CAdv_{-1}$		Constant	R^2
1	-.4145 (-.0932)		-1646616 (-.9234)	276592.5 (.9993)				-10.1155 (-.2770)		-10104353 (-.4998)	.5961
2	2.1871 (.4816)		256661.1875 (.5866)		327253.25 (.9778)			12.7217 (.5649)		-107664422 (-.5131)	.5927
3	2.1433 (.4840)		334703.6875 (.7294)			618155.4375 (1.0590)		10.9159 (.4834)		-14259190 (-.6356)	.6058
4	-1.8155 (-.5235)	19.6817 (1.7370)	-24969.375 (-.0210)	29546.3281 (.1814)						3695610 (.4072)	.7654
5	-3.4000 (-.7629)	27.0802 (2.0102)	91867 (.3047)		-216352.5 (-.5700)					14829956 (.7361)	.7812
6	-1.5610 (-0.4685)	21.8105 (2.4693)	227450.8125 (.7891)				-25940.9844 (-.3271)			4846485 (.5715)	.7696
7		19.0679 (2.3611)	108843.6875 (.3781)		-17175.3984 (-.0651)					4712407 (.3246)	.7494
8		18.7759 (3.0610	121709.9375 (.6367)							3912066 (.5543)	.7492
9	3.5850 (1.0129)		402451.374 (1.2257)		385427.375 (1.3022)					-18953184 (-1.3449)	.5602

[1/] The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination.

TABLE B.36: ESTIMATED ANNUAL GRANTS BY FOUNDATIONS -- Opera[1/]

Equation Number	A	X	DSPR	Q	DMM	ΔCty	DSF			Constant	R^2
1		527071.75 (0.39901)		5553.5351 (2.2696)			.0513 (.2867)			-40044386 (-1.73101)	0.5954
2			-2471961 (-0.4605)	3505.593 (1.9089)		-52.3530 (-0.09877)				-1940631. (-1.23166)	0.6358
3	-2.6387 (-5.2590)	-11077073 (-1.9104)		7184.05 (7.8118)						1365437 (1.0399)	.9478
4	-2.8235 (-5.5401)	-1106709 (-2.0352)	-3247599 (-1.1444)	7156.386 (8.0744)						1716448 (1.3187)	.9637

[1/] The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination.

TABLE B.37: ESTIMATED CAPACITY EXPANSION FACTOR -- Opera[1/]

Equation Number	Q	PDA	Q_{-1}	AU					Constant	R^2
1	.000768 (10.84227)	-0.8164 (-0.9650)							0.4130 (0.5291)	0.2381
2	.000244 (.3006)			.0103 (.2936)					-.0668 (-.0223)	.0392

[1/] The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination.

TABLE B.38: ESTIMATED ANNUAL FUND RAISING EXPENDITURES -- Opera[1/]

Equation Number	DSFR	CPr_{-1}	ΔQ	DSF	ΔOG	DSF_{-1}				Constant	R^2
1	-219379 (-0.57686)	0.011986 (1.4826)	-200.104 (-6.6760)							5755.4375 (0.0664)	0.9356
2		0.01125 (1.3543)	-196.71 (-6.3228)	-0.0058 (-0.6639)						13371.4531 (0.1505)	0.9372
3					.0192 (.7539)	-.0415 (-2.9914)				129394.75 (7.0750)	.7952

[1/] The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination.

B.23

TABLE B.39: ESTIMATED SUBSCRIPTION SALES -- Opera[1/]

Equation Number	P	Sbr_{-1}	Tr	P^2						Constant	R^2
1	27651.5313 (.5061)	.2963 (.7026)	31892.4023 (1.5858)							-2323568 (-1.3921)	.8267
2	-14399 (-.2693)	.8480 (3.1803)								205702.3750 (.3735)	.7395
3			43579.2617 (3.9675)	1608.3242 (.6059)						-2968661 (-3.1007)	.8093
4				-5846.3984 (-1.7691)						760076.5 (2.3611)	.3090

[1/] The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination.

TABLE B.40: ESTIMATED AVERAGE UTILIZATION RATE -- Symphony Based on the Ford Foundation Data[1/]

Equation Number	P	YD	PS	PC1	Un	Cty	Q	Cm	YDT	Constant	R^2
1	7.3301 (0.6507)	-0.000068 (-0.0097)	-44.4747 (-0.9685)	108.1960 (2.1647)	-5.4012 (-2.1662)			-0.1162 (-2.8210)		60.0307 (2.1559)	0.9618
2	-15.2153 (-3.4616)	0.008919 (3.2935)					-0.0071 (-2.9984)	0.00537 0.2713		118.6815 (6.4779)	0.9570
3	-6.5130 (-1.4913)							-0.0377 (-2.3482)	0.0344 (2.3945)	85.9129 (6.7315)	0.8745
4	-14.2125 (-6.6200)	0.0093 (4.4336)					-0.0066 (-5.1633)			113.8421 (30.1265)	0.9562

[1/] The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination.

TABLE B.41: ESTIMATED ANNUAL TOTAL TICKETED ATTENDANCE -- Symphony Based on the Ford Foundation Data[1/]

Equation Number	P	YD	PS	PC1	Um	Cty	Q	Crm	YDT	Constant	R^2
1	-349630.25 (-0.3900)	1263.3718 (2.1273)	-429127.25 (-0.0884)	103082.0 (0.0236)	-189396.125 (-1.0869)					4620893.0 (2.0308)	0.9449
2	-1613280.0 (-3.3880)	1508.4688 (2.0850)	31685.3125 (0.0082)					359.0730 (0.1074)		6812644.0 (3.7885)	0.8982
3	-877207.4375 (-0.9334)	1283.5815 (1.9054)	1155381.0 (0.2112)	-1913015.0 (-0.4523)		0.2107 (0.5695)				3919296.0 (1.4916)	0.9306
4	-405815.3125 (-0.6602)	1183.9792 (4.4295)			-182162.4375 (-2.0575)					4770117.0 (5.0121)	0.9444
5	-1558514.0 (-4.9660)	1581.6653 (6.9058)								6506604.0 (11.9250)	0.8972
6	-1580626.0 (-4.4521)	1637.4567 (4.7218)					-49.0013 (-0.2317)			6551193.0000 (10.4837)	0.8983
7	-1613091.0 (-3.7917)	1513.1274 (3.7465)						381.2908 (0.2159)		6816468.0 (4.3879)	0.8982

[1/] The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination.

TABLE B.41.a: ESTIMATED TOTAL TICKETED ATTENDANCE -- Symphony Based on the American Symphony Orchestra League Data Supplied by the Center for Policy Research[1/]

Equation Number	P	YD	PS	PC1	PC2	Tr			Constant	R^2	CO
1	-617276.5 (-3.1294)	1391.723 (2.3354)	3026881.1 (.6663)	-770414.51 (-.2958)	-366696.1 (-.1703)	33313.59 (.4751)			-65498032 (-.4860)	.9832	Yes
2	-589313 (-3.2915)	1527.425 (3.1573)	4389454.4 (1.2406)	-1132128.4 (-.4657)	-655673.44 (-.3232)				-1435559 (-.8256)	.9830	Yes
3	-621172.4 (-3.2659)	1357.77 (2.5197)	2527162.9 (.7360)	-913828.19 (-.3827)		36720.4 (.5668)			-71784192 (-.5744)	.9832	Yes
4	-595057.88 (-3.4178)	1479.54 (3.2418)	3727998.4 (1.3596)	-1497020 (-.7115)					-909360.1 (-1.3254)	.9829	Yes

[1/] The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination; CO column indicates whether or not the Cochrane-Orcutt method was used in the estimation.

TABLE B.42: ESTIMATED TOTAL OPERATING EXPENDITURES NET OF FUND-RAISING COSTS -- Symphony Based on the Ford Foundation Data[1/]

Equation Number	Q	Q^2	CMPHR							Constant	R^2
1	14987.408 (3.8400)		44645792 (5.6690)							-13238224.0 (-1.4904)	0.9752
2	69542.912 (0.4774)	-5.5649 (-0.2520)								-96638752.0 (-0.4049)	0.8443
3	32863.808 (6.1219)									-36707120.0 (-2.0011)	0.8426

[1/] The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination.

TABLE B.42.a: ESTIMATED TOTAL OPERATING EXPENDITURES -- Symphony Based on the American Symphony Orchestra League Data Supplied by the Center for Policy Research[1/]

Equation Number	LOS	AMEHAN	NPL	Tr					Constant	R^2	CO
1	90820.81 (30.7932)	4754409.6 (3.6568)		-60501.65 (-.8323)					91360128 (.6480)	.9986	No
2	91638.75 (22.3133)	4107474.5 (4.2213)	-6019.02 (-.4787)						-17445744 (-.9779)	.9985	No
3	101643.25 (27.6992)	352796.27 (0.1210)							-27184848 (-6.9991)	.9976	Yes

[1/] The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination; CO column indicates whether or not the Cochrane-Orcutt method was used in the estimation.

TABLE B.43: ESTIMATED AVERAGE REALIZED PRICE PER TICKET SOLD -- Symphony Based on the Ford Foundation Data[1/]

Equation Number	DSFR	NC	NCA	NCA_{-1}	P_{-1}					Constant	R^2
1	-1.0845 (-0.9762)		0.3341 (3.4829)		0.0666 (0.4108)					1.0155 (1.8829)	0.9729
2	-1.0815 (-1.0661)		0.3576 (5.0859)							1.0870 (2.3321)	0.9718
3	-3.8555 (-2.7683)				0.4034 (1.7254)					2.0803 (2.6068)	0.8907
4			0.4011 (6.0201)		0.0656 (0.4062)					0.5741 (1.9547)	0.9664

[1/] The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination.

TABLE 43.a: ESTIMATED PRICE OF ADMISSION -- Symphony Based on the American Symphony Orchestra League Data Supplied by the Center for Policy Research[1/]

Equation Number	NCA	NCA_{-1}	Tr						Constant	R^2	CO
1	.7865 (7.1383)	-.1139 (-1.0028)	.00436 (.4197)						-7.4049 (-.3710)	.9651	Yes
2	.8095 (8.3724)	-.09348 (-.9982)							.9740 (5.8171)	.9649	Yes
3	.8022 (7.3757)		-.00528 (-.5135)						10.9837 (.5552)	.9649	Yes
4	.7490 (17.0870)								.8382 (4.6369)	.9646	Yes

[1/] The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination; CO column indicates whether or not the Cochrane-Orcutt method was used in the estimation.

TABLE B.44: ESTIMATED ANNUAL FEDERAL GRANTS -- Symphony Based on the Ford Foundation Data[1/]

Equation Number	Q	BNEA	GNP	GF_{-1}	PDGNP	A				Constant	R^2
1	421.1389 (0.2835)	-0.0183 (-0.4833)		1.3231 (1.6812)	-12213880.0 (-1.1696)					-875168.7500 (-0.1415)	0.8117
2		-0.0192 (-0.2581)		1.1652 (1.1544)	-12640989.0 (-1.0377)	-0.0202 (-0.0074)				1004201.1875 (0.0553)	0.8066
3		-0.0197 (-0.5963)		1.1713 (2.3141)	-1259439.0 (-1.3860)					869146.3750 (1.5582)	0.8066
4		0.0628 (2.7383)			-15067424.0 (-1.2065)	-2.5714 (-1.5741)				1786960.0 (1.5891)	0.7207

[1/] The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination.

TABLE B.45: ESTIMATED ANNUAL GRANTS FROM REGIONAL GOVERNMENT AGENCIES -- Symphony Based on the Ford Foundation Data[1/]

Equation Number	Q	$BNEA_{-1}$	PDGNP	GR_{-1}	GNP	A				Constant	R^2
1	259.0288 (0.6662)	0.0218 (2.1604)		0.4188 (1.01969)	-1047.0673 (-0.9817)					841813.6875 (0.5882)	0.8798
2	292.6770 (0.7592)	0.01513 (2.0376)		0.20823 (0.5971)						-101977.9275 (-0.0966)	0.8411
3	499.4123 (1.6075)	0.01786 (1.9066)			-478.9477 (-0.5240)					-63496.875 (-0.0562)	0.8381
4		-0.0060 (-5.4949)	-1124476.0 (-3.7661)	0.8564 (26.7803)		0.9117 (18.9974)				-5838236.0 (-16.5889)	0.9990
5		-0.006167 (-2.3494)		0.8983 (12.5503)		1.0128 (10.5393)				-6608469.00 (-9.5384)	0.9937

1/ The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination.

TABLE B.46: ESTIMATED ANNUAL PRIVATE CONTRIBUTIONS -- Symphony Based on the Ford Foundation Data[1/]

Equation Number	A	CAdv	t	SE	BTPR	ATPR	SPI	$CAdv_{-1}$		Constant	R^2
1	1.5534 (1.2683)	-3.5036 (-3.6850)	88645.125 (0.1903)	11845.875 (2.0077)						-29700096.0 (-4.7609)	0.9866
2	7.3151 (1.2976)	-4.2365 (-1.7715)	549704.4375 (1.0156)		-394436.375 (-0.8620)					-40299888.0 (-4.7604)	0.9772
3	4.2459 (0.6746)	-2.9296 (-1.2285)	833457.50 (1.2789)			-237536.1875 (0.2671)				-37101408.0 (-4.4588)	0.9735
4	2.4581 (1.3541)	-2.2940 (-2.0089)	994599.0 (6.8490)				7869.1680 (0.1718)			-35526448.0 (-4.2456)	0.9732
5		-3.4449 (-3.4251)	-85101.0 (-0.1805)	150573.938 (2.6731)						-22739136.0 (-7.2401)	0.9812
6		-1.3663 (-1.4094)	1239035.0 (11.1929)		179634.750 (1.4416)					-32292064.0 (-5.2263)	0.9677
7		-1.4605 (-1.5919)	1265787.0 (11.3151)			343838.4375 (1.6587)				-33698144.0 (-5.3949)	0.9705
8		-1.4961 (-1.4159)	1066172.0 (7.2976)				39465.2773 (0.9267)			-25556240.0 (-5.9504)	0.9609
9	2.6169 (1.8660)	-2.3603 (-2.4461)	1003793.125 (8.2831)							-36145924.0 (-5.3321)	0.9730
10	1.6867 (1.2025)		1167206.0 (2.8315)	7606.6758 (0.1402)				-1.8985 (-3.0814)		-39446912.0 (-5.3410)	0.9825
11	0.4230 (0.2165)		1348007.0 (7.3936)		144244.125 (0.8417)			-1.6531 (-2.6207)		-38663760.0 (-6.2817)	0.9851
12	1.4087 (1.1638)		1182585.0 (9.8535)				24568.6094 (0.7428)	-1.8289 (-3.1499)		-38136032.0 (-5.8335)	0.9845
13			1381525.0 (15.9487)		175244.3125 (2.0686)			-1.5906 (-3.1528)		-37795408.0 (-8.9993)	0.9849
14			1402447.0 (16.0350)			318295.625 (2.2064)		-1.5947 (-3.2628)		-38852944.0 (-8.9250)	0.9858

[1/]The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination.

TABLE B.47: ESTIMATED ANNUAL GRANTS BY FOUNDATIONS -- Symphony Based on the Ford Foundation Data[1/]

Equation Number	A	X	DSFR	Q	DMM	ΔCty	DSF			Constant	R^2
1	-5.0637 (-1.4544)	-23587568.0 (-1.7544)	131855472.0 (1.7821)	19895.8281 (1.7613)	902863.0625 (0.4897)					-9226558.0 (-1.0353)	0.9889
2		-5119905.0 (-0.9897)	32521904.0 (0.9763)	4399.8828 (1.0017)	3225576.0 (2.9910)					-9158777.0 (-0.8775)	0.9971
3		-937244.50 (-0.3251)		186.0691 (0.2291)	4210052.00 (11.0703)					734511.00 (0.2951)	0.9698
4	0.7210 (0.4783)	-232081.0 (-0.0801)	2034608.0 (0.2421)		4056645.0 (7.0894)					-4075516.00 (-0.3712)	0.9716
5			258831 (1.1921)	2971.3708 (1.1966)	3807020.02 (5.3511)	4015.3806 (1.6084)				-9295878.00 (-1.1232)	0.9827
6				174.5273 (0.1867)	4451255.0 (9.00809)	2263.7780 (1.0503)				-145201.9375 (-0.0439)	0.9704

[1/] The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination.

TABLE B.48: ESTIMATED CAPACITY EXPANSION FACTOR -- Symphony Based on the Ford Foundation Data[1/]

Equation Number	Q	PDA	Q_{-1}	AU					Constant	R^2
1	0.000136 (0.8390)			-0.00453 (-0.2275)					(0.8426) (0.4299)	.3562
2				-01760 (-1.473)					2.2906 (2.5291)	.2655
3	0.0001803 (1.0342)	-.3851 (-.3396)							0.3494 (0.5755)	.3376

[1/] The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination.

TABLE B.49: ESTIMATED ANNUAL FUND-RAISING EXPENDITURES -- Symphony Based on the Ford Foundation Data[1/]

Equation Number	DSFR	CPr_{-1}	ΔQ	DSF	ΔOG	DSF_{-1}				Constant	R^2
1	-3121689.00 -0.4829)	-0.1067 (-1.2205)	-91.7561 (-79.0451)							2985098.0 (1.8892)	.5098
2		-0.1064 (-1.1166)	-86.4703 (-1.1272)	-0.0486 (-0.4332)						2973070.0 (1.7387)	.5045
					-0.0024 (-0.0750)	0.0786 (2.2917)				1031827.25 (16.6938)	.5657

[1/]The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination.

TABLE B.50: ESTIMATED SUBSCRIPTION SALES -- Symphony Based on the Ford Foundation Data [1/]

Equation Number	P	Sbr_{-1}	Tr	P^2						Constant	R^2
1	1758094.0 (3.4485)	0.5394 (2.1335)	-67823.9375 (-1.3107)							-1064146.0 (-0.4764)	.9258
2	1201811.0 (4.0213)	0.3084 (1.6078)								-3730592.0 (-3.8230)	.9003
3	1537258 (6.4868)									-4756442.0 (-5.8169)	.8574
4			7500.7539 (0.1680)	209571.50 (2.4920)						-2473506.0 (-1.1172)	.8673
5				222379.5625 (6.7461)						-2108442.0 (-5.3371)	.8667

[1/]The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination.

TABLE B.51: ESTIMATED AVERAGE UTILIZATION RATE -- Ballet[1/]

Equation Number	P	YD	PS	FCI	Un	Cty	Q	Ctm	YDT	Constant	R^2
1	2.2821 (0.2677)	-0.0760 (-2.2556)	-60.3959 (-0.1962)	270.4243 (1.0688)	-15.5759 (-1.8456)					226.1939 (2.4509)	.7577
2	4.5938 (0.3640)	-0.0721 (-1.7095)	-22.7114 (-0.0586)	168.3108 (0.3767)	-13.1121 (-1.0214)				0.0803 (0.3107)	215.4509 (1.8624)	.7688
3	13.1280 (1.7049)	-0.0469 (-1.7342)	145.5676 (0.7871)	-67.6303 (-0.6308)						45.9459 (0.7707)	.8541
4	12.7026 (1.3522)	-0.0462 (-1.4164)	140.5867 (0.6299)	-28.3568 (-0.1463		0.000039 (1.7394)			-0.0644 (-0.2714)	31.3664 (0.3501)	.8600
5	-1.2365 (-.2970)	-0.0196 (-2.6272)					0.07247 (2.8149)			112.3766 (4.3870)	.6862
6	-4.8824 (-1.1572)							-0.1763 (-2.7784)	0.1512 (2.4898)	179.2795 (5.0290)	.6562

[1/] The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination.

TABLE B.52: ESTIMATED ANNUAL TOTAL TICKETED ATTENDANCE -- Ballet[1/]

Equation Number	P	YD	PS	PC1	Um	Cty	Q	Cra	YDT	Constant	R^2
1	-211616.8125 (-0.6925)	-1650.5549 (-1.3670)	-2953063.0 (-0.7677)	8647226.0 (.9533)	-447447.6835 (-1.4789)					5434131.0 (1.6424)	.7547
2	-340360.4375 (-1.9764)	- 679.7915 (-0.5581)	-1564632.0 (-0.2401)					5581.6836 (1.0373)		4976833.0 (2.2693)	.6467
3	188325.8125 (1.5569)	- 640.9634 (-1.5088)	1471830.0 (0.5066)	-618119.6875 (-0.3670)		1.2590 (6.4892)				-298454.75 (-0.3187)	.9718
4	185218.0 (1.2375)	- 635.9536 (-1.2233)	1435450.0 (0.4036)	-331267.3125 (-0.1073)		1.2919 (3.6375)		- 470.2192 (-0.1244)		-404943.4375 (-0.2836)	.9720
5	-293710.125 (-0.9762)	346.3765 (0.9961)			-36695.3359 (-0.2248)					1624837.0 (0.9137)	.4023
6	-16674.3984 (-0.0806)	-1286.7766 (-2.2141)			-237728.0 (-1.9700)			6959.7070 (3.0235)		4557055.0 (3.1124)	.8181
7	-250274.37 (-2.5519)	- 166.827 (- .9474)					2501.5051 (4.1252)			1734674 (2.8750)	.8629
8	-253616.4 (-2.2592)	- 234.2157) (- .4310)					2413.4849 (2.5502)	309.5881 (.1330)		1940112 (1.1514)	.8635
9	-344401.9375 (-1.8849)	300.4863 (1.1636)								1907637.0 (1.6545)	.3963
10	-170818.25 (-0.6584)			-3303334.0 (-0.8578)				9089.3164 (1.9056)	-3095.6504 (-1.3018)	4112121.0 (3.5387)	.8088
11	-184666.6875 (-1.6286)	301.3545 (2.0385)					2235.9397 (3.6483)			-310814.625 (-.3463)	.8626

[1/] The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination.

TABLE B.53: ESTIMATED TOTAL OPERATING EXPENDITURES NET OF FUND RAISING COSTS -- Ballet[1/]

Equation Number	Q	Q^2	CMPHR							Constant	R^2
1	42580.032 (1.7287)	-34.6237 (-1.4559)	17588768.0 (12.0433)							-13583852.0 (-2.3192)	.9872
2	6912.608 (2.4796)		18318240.0 (12.2584)							- 5204833.0 (-4.3903)	.9819
3	28548.656 (2.8001)									- 1157431.0 (-0.2151)	.5283

[1/]The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination.

TABLE B.54: ESTIMATED AVERAGE REALIZED PRICE PER TICKET SOLD -- Ballet[1/]

Equation Number	DSPR	NC	NCA	NCA_{-1}	P_{-1}					Constant	R^2
1	4.5073 (1.1656)		0.2725 (2.2809)		-0.2013 (-0.4076)					4.6395 (2.0758)	.6672
2	4.7216 (1.3502)		0.2432 (2.7946)							3.7716 (6.0865)	.6534
3			0.1990 (1.8943)		-0.2796 (-0.5519)					5.4829 (2.5046)	.5542
4	13.6501 (4.3977)	0.00000049 (5.3678)			0.9463 (4.1841)					-3.4473 (-2.1203)	.9067

[1/]The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination.

TABLE B.55: ESTIMATED ANNUAL FEDERAL GRANTS -- Ballet[1/]

Equation Number	Q	BNEA	GNP	GF_{-1}	PDGNP	A				Constant	R^2
1	-800.4873 (-0.3488)	0.00111 (0.0542)	1358.974 (0.5084)	-0.04896 (-0.0722)						-527550.750 (-0.2511)	0.3819
2	-544.780 (-0.4050)	0.00077 (0.0526)	1478.24 (0.7254)							-824250.06 (-0.5195)	0.4698
3	167.1931 (0.1894)	0.0104 (1.7799)								278183.0625 (0.6350)	0.4140
4		0.0055 (0.3017)	759.2073 (0.3488)	-0.1466 (-0.2326)		-0.0120 (-0.0215)				-311922.9375 (-0.1519)	.3445
5		0.0104 (1.3005)		-0.0935 (-0.1929)						418405.0 (2.4365)	.3164
6		0.0048 (0.3071)	643.0551 (0.3474)			-0.0096 (-0.0196)				-237151.6875 (-0.1339)	.3327

[1/]The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination.

TABLE B.56: ESTIMATED ANNUAL GRANTS FROM REGIONAL GOVERNMENT AGENCIES -- Ballet[1/]

Equation Number	Q	$BNEA_{-1}$	PDGNP	GR_{-1}	GNP	A				Constant	R^2
1	-456.3886 (-2.0072)	-0.0045 (-1.9229)		-1.0308 (-3.5294)	1664.031 (4.8568)					-1267092.0 (-4.3204)	0.9160
2		-0.00344 (-1.9648)		-0.90817 (-4.1210)	1302.562 (5.5922)	-0.15184 (-2.9475)				-975616.188 (-4.1504)	0.9495
3		-0.0016 (-0.4456)			624.7060 (-1.6947)	-0.14751 (-1.2814)				-365442.5 (-0.8955)	0.6634

[1/]The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination.

TABLE B.57: ESTIMATED ANNUAL GRANTS BY FOUNDATIONS -- Ballet[1/]

Equation Number	A	CAdv	t	SE	BTPR	ATPR	SPI	$CAdv_{-1}$		Constant	R^2
1	-0.3178 (-0.7771)		138800.875 (0.6842)	10897.4570 (0.6001)				5.3606 (1.4518)		-6600126.0 (-2.07515)	.9709
2	-0.3444 (-0.7529		248192.6875 (2.9074)		-8351.3320 (-0.1978)			4.4054 (1.2692)		-7129500.0 (-2.1510)	.9686
3	0.0522 (0.1548)		169576.8125 (2.4486)				21125.8477 (2.1414)	5.1196 (2.1306)		-6688634.0 (-3.2185)	.9852
4			173593.5625 (3.0137)				20358.0742 (2.6613)	5.1169 (2.3737)		-6719600.0 (-3.6211)	.9851
5	-0.3057 (-0.6148)	-1.3086 (-0.4497)	377772.0625 (2.1037)	-786.8464 (-0.0397)						-11590802.0 (-5.4046)	.9577
6	-0.3629 (-0.6803)	-1.4196 (-0.4881)	367953.3125 (5.6089)			-24099.2188 (-0.2803)				-11103549.0 (-4.0852)	.9585
7		-1.0393 (-0.3861)	359543.5 (2.1695)	-636.0571 (-0.0343)						-11269642.0 (-5.7901)	.9537
8		-2.2173 (-1.0587)	324742.5 (7.3991)				20683.7587 (1.9908)			-11928739.0 (-R.0332)	.9742
9			295649.5625 (8.5543)				17563.6211 (1.7454)			-10751881.0 (-10.8115)	.9684
10	-0.2720 (-0.6611)		348332.6875 (10.1904)							-10875119.0 (-9.0417)	.9556

[1/]The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination.

TABLE B.58: ESTIMATED ANNUAL GRANTS BY FOUNDATIONS -- Ballet[1/]

Equation Number	A	X	DSPH	Q	DMM	ΔCty	DSP			Constant	R^2
1	-0.4475 (-1.05089)	-3781861 (-4.5830)	-2377617 (-1.9322)	-3163.2 (-2.[illegible]826)						7467589.0 (5.8487)	0.8914
2		-3349043 (-4.6239)	-2620354 (-2.1404)	-3934.60 (-3.5116)						6962447.0 (5.8111)	0.8514
3		-2364822 (-3.2257)		-2016.087 (-2.2889)						5068671.0 (4.7890)	0.6812
4		-1378758 (-1.6656)								3068604.0 (3.7412)	0.3934

[1/] The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination.

TABLE B.59: ESTIMATED CAPACITY EXPANSION FACTOR -- Ballet[1/]

Equation Number	Q	PDA	Q_{-1}	AU					Constant	R^2
1	-0.0009 (-1.2964)	-0.00000005 (-.2142)							1.4772 (3.7803)	.3107
2	-0.0004 (-1.0434)		-0.0068 (-0.0402)						1.75286 (3.6431)	.4316
3				-0.0106 (-1.6337)					1.7763 (3.6687)	.3079

[1/] The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination.

TABLE B.60: ESTIMATED ANNUAL FUND RAISING EXPENDITURES -- Ballet[1/]

Equation Number	DSFR	CPr_{-1}	ΔQ	DSF	ΔOG	DSF_{-1}				Constant	R^2
1	-299808.688 (-.7232)	0.0376 (1.1804)	42.8505 (.3202)							24149.305 (.3360)	.5382
2		0.0379 (1.1370)	43.8743 (.3216)	-0.0159 (-.6016)						25710.582 (.3462)	.5211
3					0.0015 (0.0286)	-0.0309 (-0.9381)				114330.75 (5.2435)	.3061
4	-299808.6 (-.7232)	0.0376 (1.1804)	42.8505 (.3202)							24149.304 (.3360)	.5382

[1/] The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination.

B.39

TABLE B.61: ESTIMATED SUBSCRIPTION SALES -- Ballet[1/]

Equation Number	P	Sbr_{-1}	Tr	P^2						Constant	R^2
1	-2467.8047 (-0.5083)	-0.7205 (-2.2848)	15601.5977 (5.1250)							-985746.9375 (-5.0655)	.9719
2	2200.3945 (0.2021)	0.8508 (5.0454)								2541.2969 (0.0425)	.8242
3			8844.4844 (9.4944)	-111.2576 (-0.1940)						-558273.0625 (-91243)	.9426

[1/] The values enclosed in parentheses are the t statistics; R^2 is the unadjusted coefficient of multiple determination.

TABLE B.62: THE VARIABLES USED IN THE MODEL FOR MUSEUMS[1/]

Variable	Description
A:	annual total attendance
CAdv:	annual advertising and promotional expenditures
CP:	annual operating, production, costs
CPr:	annual private contributions
CPrg:	annual educational and other group program costs
CRs:	annual costs of research activities
DSF:	deficit-surplus fund
DSFR:	the ratio of the deficit-surplus fund to the operating budget
G:	annual total grants
M:	membership count
MA:	annual membership attendance
NCA:	net operating cost per attendee
OR:	sum of program, publications, and services revenue
PA:	price of admission
PM:	membership price, dues
Q:	output, in terms of weighted (8-hours) days of operations, the weight is the ratio of administrative expenditures to average expenditures by all museums
ΔS:	change in the stock of exhibit items and facilities, this variable does not account for deaccessions
TR:	annual total earned and unearned income
t:	the average (individual) federal tax rate for the population of the state where the museum is located
US:	ratio of utilized to total stock of exhibit items
Um:	unemployment rate for the state
YD:	per capita disposable personal income of the population in the state
YE:	endowment income
π:	surplus revenue

[1/] All monetary values are in current dollars since the model uses cross-sectional data for 1971/72.

TABLE B.63: ESTIMATED SUM OF PROGRAMS, PUBLICATIONS, AND SERVICES REVENUE[1/]

Equation Number	CPrg	A	M						Constant	$\bar{R}^2$	F
1	1.5441 (21.2399)								10639.9775	.6446	451.1318
2	1.2680 (19.7786)	.3884 (11.2067)							-73842.9934	.7657	403.0665
3	1.2697 (19.5999)	.3907 (10.6918)	-1.7810 (-.2025)						-70404.8724	.7648	267.6679

1/ The values enclosed in parentheses are the t statistics; the critical value for all the equations at the 95 percent confidence level is 1.96; $\bar{R}^2$ is the adjusted coefficient of multiple determination; F is the F statistic for the overall relationship; the number of museums included in the analysis is 247.

B.41

TABLE B.64: ESTIMATED MEMBERSHIP COUNT[1/]

Equation Number	TR	ΔS	DSF	PM					Constant	$\bar{R}^2$	F
1	.00051 (8.1089)								1677.8262	.1379	65.7540
2	.00048 (7.4799)	-.00278 (2.2198)							1653.1538	.1462	35.6600
3	.00054 (7.8649)	-.00324 (-2.5762)	-.00039 (-2.3799)						1663.6190	.1559	25.9365
4	.00053 (7.3505)	-.00322 (-2.5524)	-.00039 (-2.3362)	7.6324 (.7694)					1561.6949	.1551	19.5807

1/ The values enclosed in parentheses are the t statistics; the critical value for all the equations at the 95 percent confidence level is 1.96; $\bar{R}^2$ is the adjusted coefficient of multiple determination; F is the F statistic for the overall relationship; the number of museums included in the analysis is 406.

TABLE B.65: ESTIMATED ANNUAL TOTAL ATTENDANCE[1/]

Equation Number	Q	YD	ΔS	PA	Um				Constant	$\bar{R}^2$	F
1	1084.1811 (8.3668)								209852.6055	.2205	70.0037
2	1021.0227 (7.6864)	120.4178 (1.9527)							-288463.7249	.2294	37.3135
3	1093.6363 (7.7375)	117.2989 (1.4768)	.7777 (1.9055)						-272559.1442	.2331	25.7239
4	1115.1566 (7.8223)	117.2346 (1.9055)	.7948 (1.5093)	-63607.5604 (-1.1221)					-247252.7277	.2339	19.6286
5	1122.934 (7.8380)	104.2977 (1.6069)	.8176 (1.5473)	-64090.1985 (-1.1292)	1560712.7493 (.6325)				-281813.5948	.2320	15.7437

[1/] The values enclosed in parentheses are the t statistics; the critical value for all the equations at the 95 percent confidence level is 1.96; $\bar{R}^2$ is the adjusted coefficient of multiple determination; F is the F statistic for the overall relationship; the number of museums included in the analysis is 245.

TABLE B.66: ESTIMATED PRICE OF ADMISSION[1/]

Equation Number	NCA	DSFR							Constant	$\bar{R}^2$	F
1	.0997 (8.7521)								.3305	.2057	76.6004
2	.1098 (9.6758)	.0745 (4.1602)							.3005	.2478	49.0999

[1/] The values enclosed in parentheses are the t statistics; the critical value for all the equations at the 95 percent confidence level is 1.96; $\bar{R}^2$ is the adjusted coefficient of multiple determination; F is the F statistic for the overall relationship; the number of museums included in the analysis is 293.

TABLE B.67: ESTIMATED ANNUAL FEDERAL GRANTS AND SUPPORT[1/]

Equation Number	A	CPrg	Q	π	DSF				Constant	$\bar{R}^2$	F
1	.9744 (7.4134)								-52955.6456	.3998	54.9592
2	.8348 (6.1111)	.8445 (2.7107)							-171683.9562	.4439	33.3342
3	.8845 (7.2881)	2.0532 (5.4862)	-2453.0041 (-4.7772)						-73794.7572	.5643	35.9685
4	.9009 (8.0336)	2.2862 (6.5147)	-2449.2783 (-5.1660)	.8156 (3.8070)					-149312.1293	.6286	35.2660
5	.8956 (8.1183)	2.3990 (6.8508)	-2407.1829 (-5.1569)	.9610 (4.2875	-.2248 (-1.9013)				-124185.7868	.6408	29.8940

[1/] The values enclosed in parentheses are the t statistics; the critical value for all the equations at the 95 percent confidence level is 1.96; $\bar{R}^2$ is the adjusted coefficient of multiple determination; F is the F statistic for the overall relationship; the number of museums included in the analysis is 82.

E.43

TABLE B.68: ESTIMATED ANNUAL STATE AND LOCAL GRANTS AND SUPPORT[1/]

Equation Number	A	Q	YD	CPrg					Constant	$\bar{R}^2$	F
1	.4381 (13.7410)								100395.0404	.4120	188.8154
2	.3855 (11.5441)	449.4776 (4.1852)							84892.899	.4463	109.0055
3	.3768 (11.1196)	425.0754 (3.9161)	57.1380 (1.4258)						-148247.3113	.4484	73.6301
4	.3771 (11.1393)	281.6644 (1.7830)	53.9343 (1.3446)	.1606 (1.2482)					-137864.933	.4496	55.7286

[1/] The values enclosed in parentheses are the t statistics; the critical value for all the equations at the 95 percent confidence level is 1.96; $\bar{R}^2$ is the adjusted coefficient of multiple determination; F is the F statistic for the overall relationship; the number of museums included in the analysis is 269.

TABLE B.69: ESTIMATED ANNUAL PRIVATE CONTRIBUTIONS[1/]

Equation Number	Q	CPrg	CAdv	ΔS	t	YD			Constant	R^2	F
1	1016.2609 (15.5447)								60647.1732	.5028	241.6378
2	682.3278 (6.6584)	.3101 (4.1419)							56421.029	.5345	137.6322
3	713.5533 (7.0664)	.3923 (5.0450)	-1.0588 (-3.2137)						61887.873	.5522	98.8240
4	695.2120 (6.7873)	.3905 (5.0221	-1.0732 (-3.2555)	-.2463 (-1.0583)					59641.6403	.5524	74.4360
5	688.8640 (6.6684)	.3901 (5.0087)	-1.0665 (-3.2277)	-.2475 (-1.0621)	211733.2086 (.5235)				25582.5697	.5510	59.4187
6	689.1118 (6.6573)	.3922 (5.0031)	-1.0660 (-3.2198)	-.2468 (-1.0564)	312728.1852 (.5779)	-10.6594 (-.2811)			54183.3697	.5492	49.3331

[1/] The values enclosed in parentheses are the t statistics; the critical value for all the equations at the 95 percent confidence level is 1.96; $\bar{R}^2$ is the adjusted coefficient of multiple determination; F is the F statistic for the overall relationship; the number of museums included in the analysis is 239.

TABLE B.70: ESTIMATED ANNUAL FOUNDATION GRANTS[1/]

Equation Number	A	DSF	Q	ΔS	CPrg				Constant	R^2	F
1	.0744 (2.5328)								64584.0927	.0372	6.4151
2	.0706 (2.3960)	.0261 (1.2365)							60567.2355	.0409	3.9841
3	.0545 (1.5919)	.0234 (1.0968)	65.4776 (.9241)						57936.0807	.0399	2.9380
4	.0535 (1.5352)	.0247 (1.0858)	69.7477 (.9268)	.0442 (.1732)					58488.4392	.0330	2.1954
5	.0528 (1.4973)	.0251 (1.0918)	58.8916 (.5701)	.0461 (.1789)	.0107 (.1549)				58339.39	.0260	1.7485

[1/] The values enclosed in parentheses are the t statistics; the critical value for all the equations at the 95 percent confidence level is 1.96; $\bar{R}^2$ is the adjusted coefficient of multiple determination; F is the F statistic for the overall relationship; the number of museums included in the analysis is 141.

TABLE B.71: ESTIMATED ANNUAL OPERATING, PRODUCTION, COSTS[1/]

Equation Number	Q								Constant	$\bar{R}^2$	F
1	4136.6917 (20.6971)								126770.4913	.4108	428.3702

[1/] The values enclosed in parentheses are the t statistics; the critical value for all the equations at the 95 percent confidence level is 1.96; $\bar{R}^2$ is the adjusted coefficient of multiple determination; F is the F statistic for the overall relationship; the number of museums included in the analysis is 614.

B.45

TABLE B.72: ESTIMATED ANNUAL EDUCATIONAL AND OTHER GROUP PROGRAMS' COSTS[1/]

Equation Number	G	DSF	M						Constant	$\bar{R}^2$	F
1	.2656 (16.0255)								1451.9521	.4819	256.816
2	.2618 (15.4962)	.0197 (1.1336)							-671.5711	.4825	129.1840
3	.2656 (14.3450)	.0191 (1.0977)	-3.1545 (-.5020)						5211.0242	.4811	85.9705

[1/] The values enclosed in parentheses are the t statistics; the critical value for all the equations at the 95 percent confidence level is 1.96; $\bar{R}^2$ is the adjusted coefficient of multiple determination; F is the F statistic for the overall relationship; the number of museums included in the analysis is 276.

TABLE B.73: ESTIMATED ANNUAL COSTS OF RESEARCH ACTIVITIES[1/]

Equation Number	ΔS								Constant	$\bar{R}^2$	F
1	-.7472 (-1.5356)								133302.7954	.0045	2.3583

[1/] The values enclosed in parentheses are the t statistics; the critical value for all the equations at the 95 percent confidence level is 1.96; $\bar{R}^2$ is the adjusted coefficient of multiple determination; F is the F statistic for the overall relationship; the number of museums included in the analysis is 302.

TABLE B.74: ESTIMATED ANNUAL ADVERTISING AND PROMOTIONAL EXPENDITURES[1/]

Equation Number	G	DSF	M						Constant	$\bar{R}^2$	F
1	.0357 (13.5676)								2385.165	.3895	184.0797
2	.0332 (12.1639)	.0084 (3.0496)							1835.6665	.4067	99.3609
3	.0301 (9.9814)	.0089 (3.2682)	2.3609 (2.3441)						-2186.9647	.4159	69.1168

[1/] The values enclosed in parentheses are the t statistics; the critical value for all the equations at the 95 percent confidence level is 1.96; $\bar{R}^2$ is the adjusted coefficient of multiple determination; F is the F statistic for the overall relationship; the number of museums included in the analysis is 288.

TABLE B.75: ESTIMATED CHANGE IN THE STOCK OF EXHIBIT ITEMS[1/]

Equation Number	YE	CPr	US						Constant	R^2	F
1	-.0788 (-8.9286)								-8211.3824	.1324	79.7205
2	-.0710 (-7.6711)	-.0299 (-2.6542)							-5477.2380	.1424	43.8505
3	-.0712 (-7.6818)	-.0294 (-2.6111)	6876.8341 (.7635)						-8392.8319	.1417	29.4042

[1/] The values enclosed in parentheses are the t statistics; the critical value for all the equations at the 95 percent confidence level is 1.96; R^2 is the adjusted coefficient of multiple determination; F is the F statistic for the overall relationship; the number of museums included in the analysis is 517.

APPENDIX C

TREND MODELS

A. Introduction

The discussion in Section V dealt with econometric models where economic theory forms the basis for the model by identifying the factors that determine the behavior of a given economic unit. An alternative to the econometric modeling is trend modeling. The fundamental difference between the two is in their methods of analysis. On the one hand the economist builds a mathematical model that embodies the key behavioral relationships between causal factors and the economic units of interest, whereas the trend model builder searches for mathematical relationships among the series of observations of the economic unit of interest without consideration of causal factors. Of course, there is a wide choice among all of the potential types of trend models. However, through the judicious use of certain assumptions the number of candidate trend models can be reduced to a manageable level.

G.E.P. Box and G.M. Jenkins developed a trend model based on the concept of stationarity. This concept states that the sequence of observations of an event is repetitive over time. This repetitive pattern is observed in the fluctuations of the observations about an increasing, constant, or decreasing trend sequence.

The implementation of the Box-Jenkins method involves the search for the optimal relationship between an observation, and/or a disturbance term, and previous observations and/or disturbance terms. This optimality is defined with reference to two processes: identification and estimation. The identification process involves the determination of the relationships between current and past values for the observations and disturbances. That is, identification involves determining the appropriate lag structure of the relationships as well as the number of observations necessary to ensure that the sequence will repeat itself (see the autoregressive and moving average discussions, below). The criterion used in the identification process is the statistical significance

of the contribution of these past observations or disturbances to the current one. The estimation process, on the other hand, utilizes the maximization of a "likelihood function" to minimize the squared differences between the true parameters (i.e., the true relationships) and the estimates. That is, to obtain the best or most efficient estimates of the parameters, one can ask the question, "What values of the parameters are likely to have given rise to the observations?" In the likelihood function, the observations are given and the parameters are treated as variables. The likelihood function to be maximized is determined from the autoregression and moving average information supplied via the earlier identification process.

The relationship between an observation and previous observations is termed an autoregressive process (AR), while the relationship between the deviation from the mean and previous disturbance terms is expressed as a moving average process (MA). Box-Jenkins models are constructed to combine both processes, so that the resulting model is an autoregressive moving-average one (ARMA). Further modifications can be introduced which allow for the use of the differences (e.g., first differences) among the observation in the analysis. These models are termed integrated autoregressive-moving-average models (ARIMA) and are the models used in this study.

These Box-Jenkins models are useful tools in forecasting, but such forecasting can be misleading at times, because of the possibility of structural changes in the phenomenon being investigated which would invalidate the basic assumption of stationarity. It should be kept in mind that this problem is not unique to trend models, but it is intensified due to the absence of exogenous variables. Such variables help to indicate the presence and the nature of the structural changes for the phenomenon of interest. Of course, it is possible to include exogenous variables in a trend model, but then it becomes more of an econometric model and less of a trend model.

Given the above caveat, the results of Box-Jenkins modeling effort can be used in policy making by both the art organizations and concerned outside agencies. These models can be used, for example, in making forecasts of earned and unearned revenues, costs, and income gaps of art organizations. Confidence intervals can be computed for such forecasts which would indicate the level of reliance one can place in the forecasts. Of course, the longer range the forecast, the less is the confidence that can be associated with it.

Before describing the Box-Jenkins methodology in detailed mathematical terms, it is prudent to reference the observations of Naylor and Seaks who stated that:

> "If one is primarily interested in forecasting, the Box-Jenkins methods may have considerable appeal. But there is some risk with Box-Jenkins methods. If they yield poor forecasts, we may be at a complete loss to explain 'Why?', since they have no underpinnings in economic theory. Furthermore, if our goal is to "explain the behavior of an economic system and not merely to grind out forecasts, then Box-Jenkins methods may be totally unacceptable..."
>
> (Naylor, T. and Seaks, T., p. 27, Box-Jenkins Methods: An Alternative to Econometric Models")

B. The Basis for a Box-Jenkins Model

A basic concept for the Box-Jenkins method is that of stationarity. This concept is defined in terms of the joint-distribution of a given variable. Given the time series $(Z_1, Z_2, \ldots Z_n)$ where the $(Z_i$'s) are observations at the equally spaced time intervals $(1,2,\ldots n)$, the following defines the concept of strict stationarity:

$$P(Z_1, Z_2, \ldots Z_m) = P(Z_{m+1}, Z_{m+2}, \ldots Z_n) \qquad \ldots(1)$$

This definition (1) states that the joint-distribution of the variable (Z) is invariant with reference to the time period defined. An example of the concept of stationarity would be

the fluctuation of the values of a variable (Z) around a fixed mean (μ). Other examples of more subtle stationarity are the fluctuations of the first differences of a variable (Z) or its growth rates around a fixed mean.

The Box-Jenkins method investigates a given time series and determines the "best" scheme that leads to stationarity for this time series. The "best" scheme is defined in terms of a maximum-likelihood function. This function is based on an assumption of normality for the joint-distribution fuction, and the determination of the likely joint-distribution function for the parameters of the model, given a set of observations. In other words, the concept of "best" is defined in terms of the most likely set of parameters, for a specified model, that gave rise to the time series at hand. The next step is that of model specification.

The stationarity examples that were given earlier dealt with the fluctuations of the values of a variable (Z) around a fixed mean (μ). These fluctuations could be the outcome of a disturbance term (u). Thus, the observed values of Z could be expressed as:

$$Z_t = \mu + u_t \qquad \ldots(2)$$

where μ : the fixed mean for (Z)

u_t: the disturbance term

(It will be assumed that the disturbance terms are independently and identically distributed with zero mean and (σ_u^2) variance.)

This relationship (2) can be inverted to express Z_t in terms of its past value and a disturbance term:

$$\mu = Z_t - u_t = Z_{t-1} - u_{t-1} \qquad \ldots(3)$$

$$Z_t = Z_{t-1} + u_t - u_{t-1} = Z_{t-1} + v_t \qquad \ldots(4)$$

where v_t: is a disturbance term equal to
$(u_t - u_{t-1})$, $E(v_t) = 0$, $Var(v_t) = 2\sigma_u^2$

These two relationships (3) and (4) form the basis for various Box-Jenkins models or processes.

C. Moving-Average Processes (MA)

Equation (2) defines a relationship where only the last disturbance term influences the current value of Z. Other models can be constructed where the relationship is based on a number of past disturbance terms:

$$Z_t = \mu + u_t + \psi_1 u_{t-1} + \psi_2 u_{t-2} + \cdots \quad \ldots(5)$$

where $\psi_1, \psi_2, \ldots$: are fixed weights
μ: a constant
u_t: a disturbance term

Thus, Z_t is equal to a fixed mean and the sum of weighted current and past disturbances. Equation (5) is conventionally written in the following form:

$$Z_t = \mu + u_t - \theta_1 u_{t-1} - \theta_2 u_{t-2} - \cdots - \theta_q u_{t-q} \quad \ldots (6)$$

where $\psi_i = -\theta_i$

The rewriting of equation (5) into the form represented by equation (6) serves two purposes:

- Equation (5) might be confused with a general linear process.
- In the case of a finite lag structure, the subscripts of the last term indicate the order of the MA-process. This is often given as MA(q).

D. Autoregressive Processes (AR)

This model is an extension of Equation (4). Thus, Z is influenced by its past values. The influence of these past values is modified by a weighting scheme:

$$Z_t = \phi_1 Z_{t-1} + \phi_2 Z_{t-2} + \ldots + \phi_p Z_{t-p} + \delta + u_t \quad \ldots(7)$$

where $\phi_1, \phi_2, \phi_3 \ldots$: are fixed weights

δ: a constant

u_t: a disturbance term

Equation (7) is an autoregressive process of order P,AR(P).

E. Mixed Models

1. Autoregressive-Moving-Average Process

A mixed model is one that is both AR and MA, namely ARMA. This model combines Equations (6) and (7) as follows:

$$\dot{Z}_t = \phi_1 \dot{Z}_{t-1} + \ldots + \phi_p Z_{t-p} + \delta + u_t - \theta_1 u_{t-1} - \ldots \theta_q u_{t-q} \quad \ldots(8)$$

where $\dot{Z}_t = \dot{Z}_t - u$

This process allows for the influence of both past values of Z and u on the current value of Z. Two sets of parameters define this process. The first set is that of $(\phi_i, \theta_i, \delta)$, while the second is (p,q). The second set is conventionally stated for the process as ARMA(p,q). The following are examples of this process:

- ARMA (1,0):

  $$Z_t = \phi_1 Z_{t-1} + \delta + u_t \quad \ldots(9)$$

  This process is equivalent to AR(1).

- ARMA (0,1):

  $$Z_t = \delta + u_t - \theta_1 u_{t-1} \quad \ldots(10)$$

  This process is equivalent to MA(1).

- ARMA (1,1):

  $$Z_t = \phi_1 Z_{t-1} + \delta + u_t - \theta_1 u_{t-1} \quad \ldots(11)$$

  This is a mixed model.

2. Integrated Autoregressive-Moving-Average Processes (ARIMA)

Previous models dealt with a stationarity for a variable (Z) without the application of any transformations to this variable. But this is not always the case, and it might be necessary to use a differencing scheme for the variable (Z) to obtain the stationarity. It might also be the case that stationarity is present in the growth rate of the variable. This indicates the need for a general model that can deal with the various possibilities. The derivation of this process is more complex than the derivation of the MA, AR or ARMA processes. The process is again defined by two sets of parameters. The first set is again the set $(\phi_i, \theta_i, \delta)$. The second set is (p,d,s,q). These parameters will be discussed with reference to the following general model:

$$(1-\phi_1 B-\phi_2 B^2-\ldots-\phi_p B^p)(1-B^s)^d \dot{Z}_t = (1-\theta_1 B-\theta_2 B^2-\ldots-\theta_q B^q)u_t \quad \ldots(12)$$

where $\dot{Z}_t = Z_t - \mu$ if d=o, and $\dot{Z}_t = Z_t$ if d>o

Assume for the present that the parameter (s) is excluded from the specification of the model. Thus, the model is an ARIMA (p,d,q) process. The operator (B) is a backshift operator. It provides a method of deriving the appropriate differencing scheme. B is (B) .nsi af follows:

$$BZ_t = Z_{t-1}$$

$$BZ_{t-1} = Z_{t-2}$$

therefore $B^2 Z_t = BBZ_t = BZ_{t-1} = Z_{t-2}$

or in general $B^k Z_t = Z_{t-k}$.

Thus, if (p=1,d=1,q=2) the ARIMA (1,1,2) process gives:

$$(1-\phi_1 B)(1-B)^1 \dot{Z}_t = (1-\theta_1 B-\theta_2 B^2)u_t \quad \ldots(13)$$

$$(1-\phi_1 B)(\dot{Z}_t-\dot{Z}_{t-1}) = (1-\theta_1 B-\theta_2 B^2)u_t \quad \ldots(14)$$

Define $\Delta\dot{Z}_t = \dot{Z}_t - \dot{Z}_{t-1}$ ...(15)

Then, by the substitution of $(\Delta \dot{Z}_t)$ in Equation (14) the process yields:

$$\Delta \dot{Z}_t = \phi_1 \Delta \dot{Z}_{t-1} + u_t - \theta_1 u_{t-1} - \theta_2 u_{t-2} \qquad \ldots(16)$$

This example demonstrates the role of the parameter (d). This parameter introduces differencing in the processes. This differencing becomes more complex as d takes on value greater than (1). But regardless of the value for d each Z is affected by an unbroken sequence of its own past values. This sequence will be of length p. Obviously, such an ordering of the relationship is not always representative of true life observations. Examples of this are found in cyclical variations in Z. Thus, the concept of seasonality and the parameter (s) are introduced.

This parameter (s) operates by deriving the differencing for $(\dot{Z}_t)$ and $(\dot{Z}_{t-s})$. An example of this cyclical behavior is given for ARIMA (1,1,4,2) where (p=1,d=1,s=4,q=2):

$$(1 - \phi_1 B)(1 - B^4)^1 \dot{Z}_t = (1 - \theta_1 B - \theta_2 B^2) u_t \qquad \ldots(17)$$

$$(1 - B^4)^1 \dot{Z}_t = \dot{Z}_t - \dot{Z}_{t-4} = w_t \qquad \ldots(18)$$

$$w_t = \phi_1 w_t + u_t - \theta_1 u_{t-1} - \theta_2 u_{t-2} \qquad \ldots(19)$$

Finally, a simplification of the notation is introduced for (12):

$$\left[1 - \sum^{p} \phi_i B^i\right] (1 - B^s)^d \dot{Z}_t = \left[1 - \sum^{q} \theta_j B^j\right] u_t \qquad \ldots(20)$$

F. Forecasting ARIMA Processes

The forecasting in the ARIMA processes is done in a recursive fashion. Thus, given the observations $(\dot{Z}_{t-n}, \ldots \dot{Z}_{t-1}, \dot{Z}_t)$ the forecasting of $(\dot{Z}_{t+1}, \dot{Z}_{t+2}, \ldots)$ is done by computing the value of $(\dot{Z}_{t+1})$ first then the value of $(\dot{Z}_{t+2})$ and so on. This becomes clear if a simple ARIMA process is used. Given ARIMA (1,0,0,2)

BLANK PAGE
DO NOT FILM

the process yields:

$$\dot{Z}_t = \phi_1 \dot{Z}_{t-1} + u_t - \theta_1 u_{t-1} - \theta_2 u_{t-2} \quad \ldots(21)$$

therefore $\dot{Z}_{t+1} = \phi_1 \dot{Z}_t + u_{t+1} - \theta_1 u_t - \theta_2 u_{t-1}$ $\ldots(22)$

and so on.

The forecasting processes for the differencing processes are essentially the same. The variance and standard deviation for the forecasts can be computed. By assuming normality, it is possible to construct confidence intervals for the forecasts.

No presentation is made in this discussion of the relationship between the autocorrelations and the parameters (ϕ_i, θ_i, δ). The interested reader is referred to Charles R. Nelson's book Applied Time Series Analysis for Managerial Forecasting.